

578
PAGE
VOLUNTEER
— AND —
MONARCH
BOILERS

for STEAM
and HOT WATER
HEATING



THE WM H. PAGE
BOILER CO.



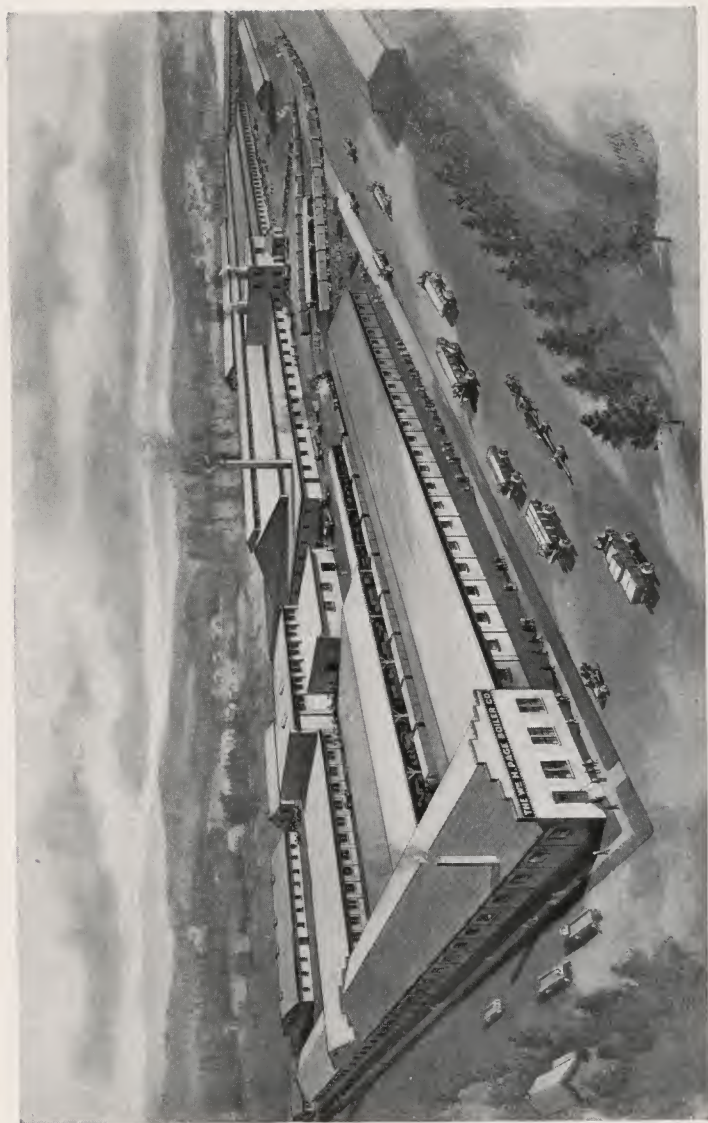
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MEADVILLE PLANT

CATALOGUE & PRICE LIST

P A G E

VOLUNTEER AND MONARCH
STEAM AND HOT WATER HEATING

B O I L E R S

AND SPECIALTIES

EFFECTIVE JANUARY 3RD, 1916
SUPERSEDING ALL FORMER LISTS

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THE WM. H. PAGE BOILER CO.

ESTABLISHED 1856

INCORPORATED 1877

GENERAL OFFICES: 141-145 W. 36TH ST., NEW YORK

BRANCHES: BOSTON, 100 HIGH ST., CHICAGO, 342 FRANKLIN ST.

PHILADELPHIA, 117 N. 16TH ST., CLEVELAND, BUILDERS' EXCHANGE

FACTORIES: MEADVILLE, PENN., NORWICH, CONN.

AGENCIES IN ALL CITIES



ANNOUNCEMENT

Generally acknowledged supremacy is not the work of a day, or a year, but the cumulative result of many years' leadership which compels gradual recognition and emulation on the part of others in the same field.

It is not the outcome of claims or arguments, but solely the result of years of striving for the attainment of an ideal, counting no effort too great to bring about that superlative degree of excellence which gains recognition upon merit alone.

We commenced the manufacture of steam and hot water heating apparatus over half a century ago and our boilers may now be found in all classes of buildings, not only throughout the United States but in many foreign countries and we are to-day the largest maker of boilers exclusively in the world. That this has been accomplished with little advertising other than from satisfied and enthusiastic users is, in itself, an indication of success, but it has only been possible through constant efforts to improve the quality of our product.

That we have attained success in the production of boilers unequalled in economy, efficiency, design, durability and ease of operation is attested by the many thousands of users of boilers of our manufacture, to whose endorsement we are indebted for increased sales and consequent prosperity.

Several years ago the demand for our boilers reached such proportions as to necessitate our seeking larger and better facilities for their manufacture and at Meadville, Pennsylvania, in the heart of the iron, coal and natural gas section, we now operate one of the most extensive, best equipped and thoroughly up-to-date plants devoted to the production of boilers.

The illustration of our boilers comprise both complete and sectional views and with the descriptive matter show very clearly their construction and many superior features not found in other boilers.

THE WM. H. PAGE BOILER CO.

“VOLUNTEER” STEAM AND HOT WATER BOILERS



The “Volunteer” Boilers, as herein described, represent the result of half a century’s practical experience in the manufacture of heating apparatus, and is well known as one of the most popular and successful boilers ever produced. The present demand that has developed for them is largely due to the recommendation of their many satisfied and enthusiastic users, who are their best advertisers.

“Volunteer” Boilers are made entirely of the best quality of cast iron, so constructed as to provide perfect freedom for expansion and contraction. The only joints or connections are formed of heavy cast iron threaded nipples, iron to iron, making a perfect and permanent joint with no possibility of leaks from any cause whatever.

The “Volunteer” Steam and Water Boilers, with exception of the top section are identical in construction; the top section of the water boiler being six inches lower than the dome of the steam boiler, in order to reduce the amount of water, to enable it to readily absorb the heat units and circulate freely and rapidly.



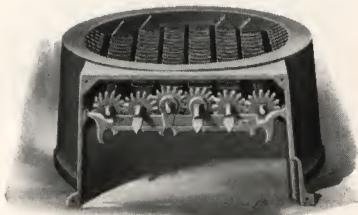
“Volunteer” Boilers are adapted for burning any grade of hard and soft coal, wood, lignites, gas, oil, or anything that will burn.

PARTICULAR ATTENTION is called to the accompanying illustrations and comprehensive description of the parts used in the construction of our "Volunteer" Boilers:

"VOLUNTEER" ASH PIT AND GRATE

The Circular ash pit or base, which also forms the support for the grate and fire pot, allows ample depth for accumulation of ashes, and with the exception of the grates and front is made in one piece.

The "Volunteer" patent triangular revolving grate used in our boilers is conceded to be far superior to any other style of grate ever used. It is easily operated, all sizes having two or more shaker bars and as it thoroughly grinds up and deposits the ashes in the ash pit and clinkers are not allowed to form, there is no necessity of using a poker or slicer bar. The larger sizes of our boilers, from thirty inches up, are fitted with a heavy bridge, under the center of the bars, which prevents warping and prolongs the life of the grate.



By occasionally revolving the bars one-third and exposing another side to the fire they will remain straight and if ashes are not allowed to accumulate underneath they will last a lifetime.

EASE OF CHANGING THE GRATE

The Grate Bars fit into holes in back of the base and the front ends rest in grooves on a supporting bar held in place by the Ash Pit Front.

By taking off this Front, which can be done by removing the four bolts, this supporting bar falls forward and the entire grate or any part of it can be removed and new bars put in, if necessary, in a few minutes.

“VOLUNTEER” FIRE POT

The “Volunteer” Fire Pot is circular in form, with water space all around it. This is made in a single casting, avoiding all joints and precluding the possibility of leakage.



Showing arrangement of its pin projections and extended surface over the fire. A combination that means great economy of fuel.

The inner surface of the fire pot is covered with a multiplicity of fine points projecting into the fire, thereby keeping the fire broken at the outer edges and effectually preventing the water from chilling the fire, and the overhanging radial self-cleaning arms at the top add materially to the amount of the direct fire surface in the boiler.

The fire pot is of liberal depth, which allows for the deep, slow fire, which insures the best and most economical results with minimum amount of attention to the fire.

All fire pots are provided with cored openings for the introduction of coil or water-back for domestic water heating.

NIPPLE CONNECTIONS

All joints are made with heavy cast iron threaded nipples. This makes a perfect and permanent connection, the most reliable known to mechanics, and is not affected by expansion and contraction, eliminating all possibility of leaks from any cause whatever.



Screw Nipple

“VOLUNTEER” SECTIONS

The “Open” and “Closed” sections above fire-pot are used alternately, the former allowing the products of combustion to pass through the openings and the latter, forcing the products of combustion to pass around and over the edges. In this manner the gases are retained in the boiler until practically all the heat is absorbed by the water.



Open Section

This arrangement of the sections with their sensitive water-ways present to the action of the fire the most effective heating surface ever devised, and is acknowledged by leading heating engineers to be the most efficient and economical construction.



Closed Section

“VOLUNTEER” STEAM DOME

The steam dome on our “Volunteer” Boilers provides a very liberal steam space, thus allowing for ample steam in reserve and also insuring dry steam, which is essential for efficient and noiseless operation.



Steam Dome

CASINGS

Extending from the outer edge of fire pot to the upper section, or dome, there are cast iron casings. These casings are made in segments and are interchangeable, easily applied, with no possibility of rusting, wearing out or breaking. They form in themselves a perfect chamber for the retention of products of combustion, compelling these to follow such channels as will give best results.

EASE OF CLEANING

The "Volunteer" Boilers are provided with large doors in front and back of jacket casing and in smoke hood, through which all the fire surfaces are easily accessible for cleaning. This is a very essential feature, as in order to obtain full efficiency and economy, these surfaces should be kept clean.

"VOLUNTEER" SMOKE HOOD WITH CHECK-DRAFT



The back outlet smoke hood is especially adapted for low ceilings, and is regularly furnished with "Volunteer" Boilers unless top outlet is specified when ordering.

AUTOMATIC REGULATOR

“VOLUNTEER” Steam Boilers are equipped with regulator and check drafts for controlling the drafts automatically. This regulator is so sensitive, and the check drafts with which it is connected by chain being balanced like a pair of scales, the slightest change in pressure will affect them, automatically keeping the steam at the right point for economical heating.

TESTS AND DURABILITY

Page Boilers are made of the finest grade of cast iron and by the best workmanship. All parts are accurately machined and fitted, and thoroughly tested to 100 pounds hydrostatic pressure, and after they are assembled the completed boilers are again subjected to another test at the same pressure as an extra precaution.

Water and fuel gases have no appreciable effect on cast iron, while they are highly destructive to sheet iron and steel. Cast iron boilers are practically indestructible. We do not know how long Page Boilers will last but know of some that have been in constant service for over fifty years, and have yet to hear of one wearing out.

With proper care and attention they will outlive the building in which they are installed.

The capacities of all our boilers are thoroughly established by long and severe tests under every conceivable condition, and are absolutely safe and reliable.

VOLUNTEER STEAM BOILERS



Number of Boiler	8-Hour Rating Square Feet Note *	Diameter of Grate and Fire Pot Inches	Area of Grate Square Feet	Number of Sections, †	Height of Water Line Inches	Number and Size of Outlets, Inches	Number and Size of Inlets Inches	Diameter of Smoke Pipe	List Price
0	200	15	1.23	1	42 ¼	2-2	2-2	7	\$114
1	250	15	1.23	2	46 ¼	2-2	2-2	7	132
1½	275	15	1.23	3	50 ¼	2-2	2-2	7	141
2	300	15	1.23	4	54 ¼	2-2	2-2	7	150
3	350	18	1.76	2	48 ¾	2-2½	2-2½	7	167
3½	375	18	1.76	3	53	2-2½	2-2½	7	179
4	400	18	1.76	4	57 ¼	2-2½	2-2½	7	193
5	475	21	2.40	2	52	2-3	2-3	8	213
5½	525	21	2.40	3	57	2-3	2-3	8	226
6	575	21	2.40	4	62	2-3	2-3	8	240
7	675	25	3.41	2	52 ¼	2-3	2-3	10	293
7½	750	25	3.41	3	57 ½	2-3	2-3	10	317
8	825	25	3.41	4	62 ¾	2-3	2-3	10	338
9	1000	30	4.90	2	55 ½	2-3½	2-3½	10	389
9½	1150	30	4.90	3	60 ¾	2-3½	2-3½	10	437
10	1300	30	4.90	4	66	2-3½	2-3½	10	477
11½	1700	36	7.07	3	60 ¼	2-4	2-4	12	585
12	2000	36	7.07	4	65 ¾	2-4	2-4	12	690
13½	2800	42	9.62	3	62 ½	2-4	4-4	12	930
14	3300	42	9.62	4	68 ½	2-4	4-4	12	1020
16	4000	42	9.62	4	73 ½	2-5	4-4	12	1180

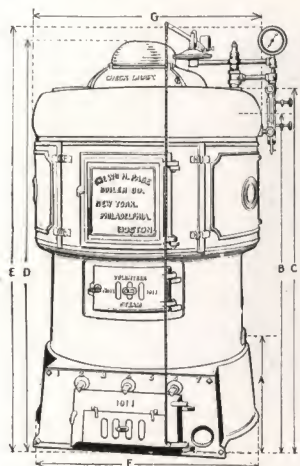
SOFT COAL: A boiler one size larger is required when Soft Coal is to be used for fuel, than would be used for Hard Coal.

*Number of sections above listed includes dome.

†See pages 16 and 40 in regard to ratings.

Opposite page gives full measurements.

VOLUNTEER STEAM BOILER MEASUREMENTS



No.	A	B	C	D	E	F	G
0	16 1/4"	42 1/4"	46"	53"	56 1/2"	26 1/4"	24 1/2"
1	16 1/4"	46 1/4"	50"	57"	60 1/2"	26 1/4"	24 1/2"
1 1/2	16 1/4"	50 1/4"	54"	61"	64 1/2"	26 1/4"	24 1/2"
2	16 1/4"	54 1/4"	58"	65"	68 1/2"	26 1/4"	24 1/2"
3	17 3/4"	48 3/4"	52 1/4"	59 1/4"	63 1/4"	27"	26 3/4"
3 1/2	17 3/4"	53"	56 1/2"	63 1/2"	67 1/2"	27"	26 3/4"
4	17 3/4"	57 1/4"	60 3/4"	67 3/4"	71 3/4"	27"	26 3/4"
5	19 1/2"	52"	56"	64"	66"	30 1/2"	31 1/4"
5 1/2	19 1/2"	57"	61"	69"	71"	30 1/2"	31 1/4"
6	19 1/2"	62"	66"	74"	76"	30 1/2"	31 1/4"
7	19 1/2"	52 1/4"	56 1/2"	68 1/2"	67 1/4"	35"	35 3/4"
7 1/2	19 1/2"	57 1/2"	61 3/4"	71 1/2"	72 1/2"	35"	35 3/4"
8	19 1/2"	62 3/4"	67"	76 1/2"	77 3/4"	35"	35 3/4"
9	20"	55 1/2"	59"	69 3/4"	69"	42 3/4"	40"
9 1/2	20"	60 3/4"	64 1/4"	75"	74 1/4"	42 3/4"	40"
10	20"	66"	69 1/2"	80 1/4"	79 1/2"	42 3/4"	40"
11 1/2	19 1/2"	60 1/4"	65"	75 1/2"	75 1/4"	47 1/2"	48 1/4"
12	19 1/2"	65 3/4"	70 1/2"	81"	80 3/4"	47 1/2"	48 1/4"
13 1/2	19 1/2"	62 1/2"	70 1/2"	71 1/2"	78"	54 1/2"	55 1/2"
14	19 1/2"	68 1/2"	76 1/2"	77 1/2"	84"	54 1/2"	55 1/2"
16	19 1/2"	73 1/2"	77 1/2"	88"	89 1/2"	54 1/2"	70 1/2"

VOLUNTEER HOT WATER BOILERS



Number of Boiler.	8-Hour Rating Square Feet Note *	Diameter of Grate and Fire Pot Inches.	Area of Grate Square Feet	Number of Sections †	Number and Size, Outlets and Inlets Inches.	Diameter of Smoke Pipe Inches.	List Price.
0	325	15	1.23	1	2-2	7	\$97
1	400	15	1.23	2	2-2	7	114
1½	450	15	1.23	3	2-2	7	131
2	475	15	1.23	4	2-2	7	136
3	550	18	1.76	2	2-2½	7	154
3½	600	18	1.76	3	2-2½	7	164
4	650	18	1.76	4	2-2½	7	184
5	750	21	2.40	2	2-3	8	197
5½	850	21	2.40	3	2-3	8	213
6	925	21	2.40	4	2-3	8	227
7	1050	25	3.41	2	2-3	10	274
7½	1200	25	3.41	3	2-3	10	300
8	1325	25	3.41	4	2-3	10	321
9	1600	30	4.90	2	2-3½	10	372
9½	1850	30	4.90	3	2-3½	10	414
10	2100	30	4.90	4	2-3½	10	457
11½	2700	36	7.07	3	2-4	12	559
12	3200	36	7.07	4	2-4	12	645
13½	4500	42	9.62	3	4-4	12	865
14	5275	42	9.62	4	4-4	12	996
16	6500	42	9.62	6	4-4	12	1130

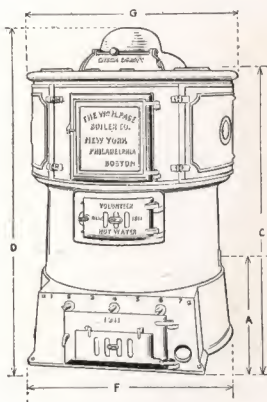
SOFT COAL: A boiler one size larger is required when Soft Coal is to be used for fuel, than would be used for Hard Coal.

†Number of sections above listed includes hot water top.

*See pages 16 and 40 in regard to ratings.

Page opposite gives full measurements.

VOLUNTEER WATER BOILER MEASUREMENTS



No.	A	C	D	F	G
0	16 1/4"	40"	47"	26 1/4"	25 1/4"
1	16 1/4"	44"	51"	26 1/4"	25 1/4"
1 1/2	16 1/4"	48"	55"	26 1/4"	25 1/4"
2	16 1/4"	52"	59"	26 1/4"	25 1/4"
3	17 3/4"	45 1/2"	52 1/2"	27"	27"
3 1/2	17 3/4"	49 3/4"	56 3/4"	27"	27"
4	17 3/4"	54"	61"	27"	27"
5	19 1/2"	50"	58"	30 1/2"	31 3/4"
5 1/2	19 1/2"	55"	63"	30 1/2"	31 3/4"
6	19 1/2"	60"	68"	30 1/2"	31 3/4"
7	19 1/2"	50 3/4"	60 3/4"	35"	36"
7 1/2	19 1/2"	56"	66"	35"	36"
8	19 1/2"	61 1/4"	71 1/4"	35"	36"
9	20"	52 1/2"	63 1/4"	42 3/4"	41"
9 1/2	20"	57 3/4"	68 1/2"	42 3/4"	41"
10	20"	63"	73 3/4"	42 3/4"	41"
11 1/2	19 1/2"	56 1/2"	67"	47 1/2"	49"
12	19 1/2"	62"	72 1/2"	47 1/2"	49"
13 1/2	19 1/2"	57"	70"	54 1/2"	53 1/4"
14	19 1/2"	63"	76"	54 1/2"	53 1/4"
16	19 1/2"	75 1/4"	88 1/4"	54 1/2"	53 1/4"

METHOD USED FOR ESTABLISHING RATINGS

(Derived from Actual Tests)

Number of Boiler.	A Fuel Available Anthracite, Lbs.	B Rekindling Reserve Lbs.	C Adequate Fuel Charge Lbs. (A + B)	D Steam Produced per Lb. Coal (evaporative power) Lbs.	E Total Steam Capacity, Lbs. (Heating power) (A × D)	F 8-Hour Rating Square Feet	G Area of Square Cornered Chimney Flue Square Inches.	H Height of Chimney Flue Feet.
0	54	17	71	7.5	405	200	64	30
1	63	17	80	8.	504	250	64	30
1½	65	17	82	8.5	553	275	64	35
2	67	17	84	9.	603	300	64	35
3	88	22	110	8.	704	350	64	30
3½	91	22	113	8.5	774	375	64	35
4	93	22	115	9.	837	400	64	35
5	119	32	151	8.	952	475	96	35
5½	124	32	156	8.5	1054	525	96	40
6	129	32	161	9.	1161	575	96	40
7	169	45	214	8.	1352	675	144	35
7½	177	45	222	8.5	1505	750	144	40
8	184	45	230	9.	1676	825	144	40
9	250	72	322	8.	2000	1000	144	40
9½	271	72	343	8.5	2304	1150	144	45
10	289	72	361	9.	2601	1300	144	50
11½	400	111	511	8.5	3400	1700	192	50
12	445	111	556	9.	4005	2000	192	50

When load attached to boiler consists of direct radiation installed in a residence for 70°, the heat condensing power of the radiation and piping combined, rarely exceeds 0.25 (¼) lbs. of steam per sq. ft. per hour.

The capacity of Page Volunteer boilers as indicated in the above table is determined on this basis and with anthracite coal containing 12,000 B.T.U., as fired.

If load attached to boiler has a condensing power exceeding 0.25, such as occurs in greenhouses, factories, etc., the factor representing the increased condensation should be used.

To establish 8-hour steam rating in sq. ft., divide the total steam capacity in pounds by 8 and divide by 0.25.

To establish rating for longer or shorter period divide total steam capacity by number of hours and divide by 0.25.

To determine hourly potential energy in B.T.U. divide total steam capacity by 8 and multiply by the latent heat of evaporation, 970.

Hourly potential energy in B.T.U. divided by 240 for steam and 150 for water, gives 8-hour rating (which factors apply to house heating conditions only).

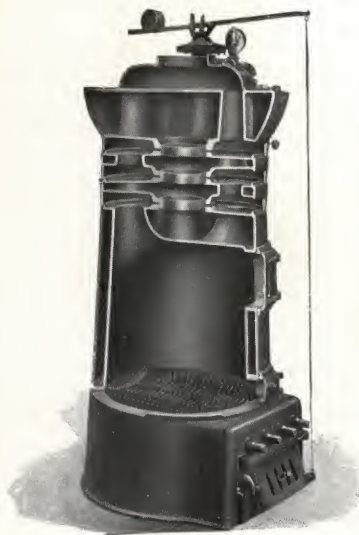
VOLUNTEER JUNIOR

Steam and Hot Water Boilers



No. 23 C Volunteer Junior Steam Boiler

THE VOLUNTEER JUNIOR STEAM AND HOT WATER BOILERS



Sectional View No. 23D Volunteer
Junior Steam Boiler

The VOLUNTEER JUNIOR Steam and Hot Water Boilers are constructed on the same general lines as their parent, the "VOLUNTEER" and are designed to meet the demand for heating residences and small buildings of every description, and also for heating water for supplying bathrooms, kitchens, laundries, barber shops and innumerable other connections where an abundance of hot water is required.

The VOLUNTEER JUNIOR Boilers are made entirely of the best grade of cast iron, with push nipple connections between sections, and are shipped all assembled ready for piping, effecting a big saving in time and labor of contractor in erecting. The ash pit, or base is of ample depth to allow for the accumulation of ashes and is provided with our improved triangular revolving grate, with exception of No. 11, which has flat shaking grate.



No. 15A Volunteer Junior
Water Boiler or
Tank Heater

The fire pot is made in a single casting, and as will be seen from the sectional view is of exceptional depth which provides for carrying a deep body of fire, insuring slow and thorough combustion which, combined with the large area of heating surface presented to the action of the fire, makes a most efficient and economical heater, capable of maintaining fire for a long period without attention.



No. 15B Volunteer Junior
Water Boiler or Tank Heater

These Heaters are adapted for burning any grade of hard or soft coal, wood, lignites, gas, oil, or anything that will burn.

The capacity, dimensions and price list will be found in tabulated list on next page.



No. 23C Volunteer Junior
Water Boiler



Volunteer Junior
Ash Pit and Grate

VOLUNTEER JUNIOR STEAM BOILERS

Ratings, Dimensions and Price List

Number of Boiler	Rating Square Feet Note *	Diameter Grate and Firepot	Number of Sections †	Height of Water Line	Height to Top Outlets	Height Over All	Number and Size of Outlets and Inlets	Diameter of Smoke Pipe	List Price
15 B	250	15"	1	43"	46 1/4"	56 1/4"	2—2"	6"	\$132.00
17 B	300	17"	1	45"	48"	58"	2—2 1/2"	7"	150.00
17 C	350	17"	2	49"	52"	62"	2—2 1/2"	7"	167.00
17 D	400	17"	3	53"	56"	66"	2—2 1/2"	7"	193.00
19 B	425	19"	1	46"	49"	59"	2—2 1/2"	7"	199.00
19 C	475	19"	2	50"	53"	63"	2—2 1/2"	7"	213.00
19 D	525	19"	3	54"	57"	67"	2—2 1/2"	7"	226.00
23 B	600	23"	1	47"	50 1/2"	62"	2—3"	9"	254.00
23 C	675	23"	2	51"	54 1/2"	66"	2—3"	9"	293.00
23 D	750	23"	3	55"	58 1/2"	70"	2—3"	9"	317.00
23 E	825	23"	4	59"	62 1/2"	74"	2—3"	9"	338.00

VOLUNTEER JUNIOR WATER HEATERS

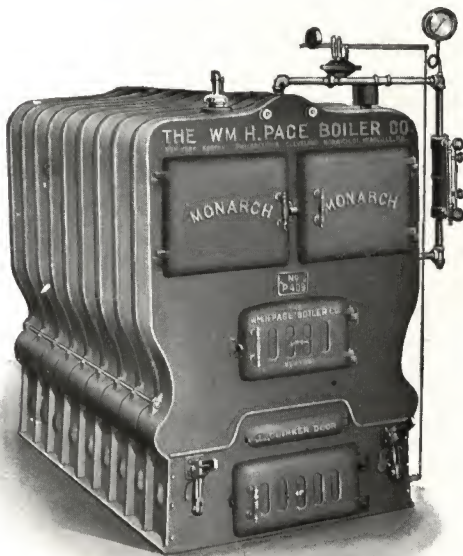
Number of Boiler	Rating Square Feet Note *	Tank Capacity Gallons	Diameter Grate and Firepot	Number of Sections †	Height to Top Outlets	Height Over All	Number and Size of Outlets and Inlets	Diameter of Smoke Pipe	List Price
11 A	150	175	11"	0	33"	37"	2—1 1/2"	5"	\$ 60.00
11 B	200	225	11"	1	38"	42"	2—1 1/2"	5"	70.00
15 A	325	375	15"	0	38"	42"	2—2"	6"	97.00
15 B	400	450	15"	1	43"	47"	2—2"	6"	114.00
17 B	475	575	17"	1	44 1/2"	54 1/2"	2—2 1/2"	7"	136.00
17 C	550	650	17"	2	48 1/2"	58 1/2"	2—2 1/2"	7"	154.00
17 D	625	725	17"	3	52 1/2"	62 1/2"	2—2 1/2"	7"	172.00
19 B	650	800	19"	1	46"	50"	2—2 1/2"	7"	184.00
19 C	750	900	19"	2	50"	54"	2—2 1/2"	7"	197.00
19 D	850	1000	19"	3	54"	58"	2—2 1/2"	7"	213.00
23 B	1000	1200	23"	1	47 1/2"	52 1/2"	2—3"	9"	242.00
23 C	1125	1300	23"	2	51 1/2"	56 1/2"	2—3"	9"	282.00
23 D	1200	1400	23"	3	55 1/2"	60 1/2"	2—3"	9"	300.00
23 E	1325	1500	23"	4	59 1/2"	64 1/2"	2—3"	9"	321.00

SOFT COAL: A Boiler one size larger is required when soft coal is to be used than for hard coal.

† Number of Sections above listed includes Steam Dome or Water Top Section.

* See Note on Page 40 in regard to Ratings.

MONARCH STEAM AND HOT WATER BOILERS



Monarch Steam Boiler, Push Nipple Type

MONARCH STEAM AND HOT WATER BOILERS

THE "MONARCH" SECTIONAL STEAM AND HOT WATER BOILERS, as herein described represent the result of half a century's practical experience in the manufacture of heating apparatus, and are produced in a modern plant equipped with the latest improved machinery under the personal supervision of expert engineers. They are designed particularly for use in large heating work, and their convenience in installing, ease of operation and economy in fuel are but a few of the many advantages that will be fully appreciated.

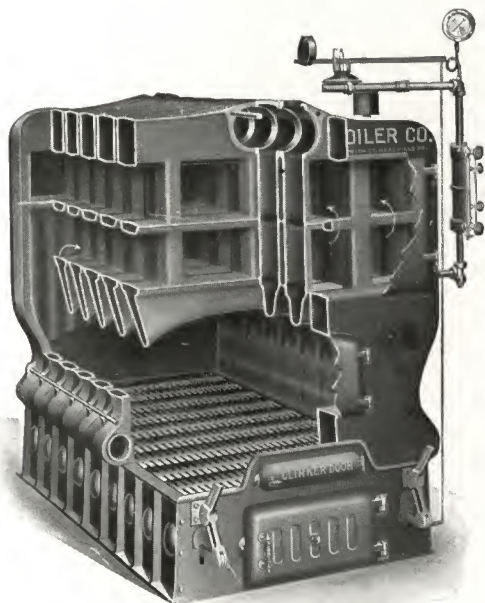
In the construction of these boilers particular attention was given to maintaining the proper ratio of grate to heating surface—which is a very important feature—expense was not considered and our efforts resulted in providing boilers with more actual and effective surface than can be found in other forms of cast-iron sectional boilers.

A glance at the sectional view will give a comprehensive idea of the Monarch construction, showing the deep combustion chamber, sensitive water-ways and enormous amount of heating surface presented to the action of the fire, which combined with the long travel of the gases of combustion utilize all the effective heat units, giving the highest efficiency with the most economical consumption of fuel.

MONARCH CONNECTIONS

The "MONARCH" is made with two forms of connections for joining the sections, one termed "Push-nipple," consisting of heavy machine turned, smooth tapered nipples made of cast iron, the same as the boiler, and held together by heavy tie rods. The other is known as "Header" type, the sections being connected independently to a header or manifold by means of lock-nut threaded nipples. Neither connections are in any way exposed to the action of the fire, and are unaffected by expansion or contraction, and insure absolutely tight and permanent joints.

MONARCH BOILER



Sectional View Monarch Boiler, Push Nipple Type

The push-nipple form is lower in height, which is a particularly advantageous feature where head room is deficient, obviating the necessity in shallow cellars of digging a pit in which to set the boiler. In all other respects both constructions are identical.

All "MONARCH" Steam and Water Boilers are made on the unit or sectional principle, and their capacity can be increased or diminished by adding or taking from the number of sections. Therefore, should the building be enlarged at any time after boiler is installed its capacity can be increased by the addition of more sections to meet the requirements.



Front Section

SECTIONS

The cuts of the sections of our "MONARCH" Boilers show the large amount of effective and direct fire surface, thus permitting an immediate response to the action of the fire.

Cored openings are provided in the Back sections for the insertion of coil or Water Back for domestic water supply.



Intermediate Section

The FIRE BOX of the "MONARCH" Boiler, is of ample depth and capacity to allow for a sufficient amount of fuel to carry the fire for a long period without attention.



Bridge Wall Section, used in large boilers to reduce grate



Inside of Back Section



All parts of the "MONARCH" Boiler, are accurately machined and fitted, and thoroughly tested to 100 lbs. hydrostatic pressure, before leaving our plant.

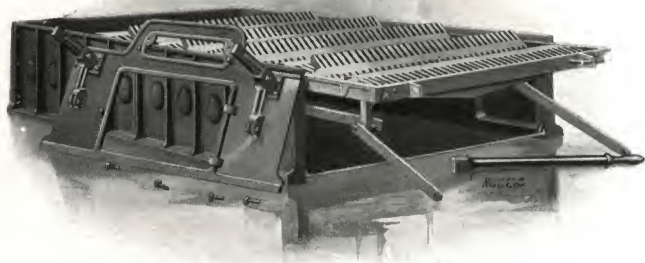
Outside of Back Section

THE MONARCH GRATES

The Grate Bars are divided into two sections, each operated by a separate lever, thus permitting agitating the whole body of fire or only certain segments of it.

By removing the front panel of the ash pit (see cut) the entire grate frame can be withdrawn, giving free access to every part of the grate.

An excellent feature of the "MONARCH" ash pit is, that when adding sections to the boiler, new sections can be also added to the ash pit, obviating the necessity of an entire new ash pit.



EASE OF CLEANING

"MONARCH" Boilers, being equipped with large front and rear clean-out doors, give free and easy access to every part of the fire surface, thus permitting thorough cleaning of all interior parts of the boiler. This is a very essential feature, as in order to obtain full efficiency and economy these surfaces should be kept clean.

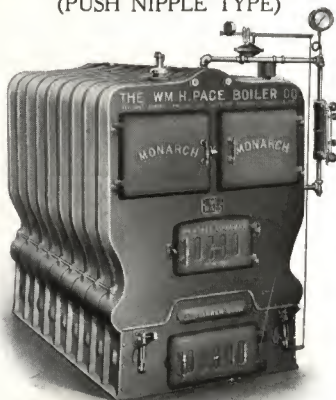
MONARCH WATER BOILER



Monarch Water Boiler, Push Nipple Type

MONARCH STEAM AND WATER BOILERS

(PUSH NIPPLE TYPE)



"MONARCH" STEAM BOILERS "E" SERIES

Number of Boiler.	Number of Sections.	8-Hour Rating Square Feet. *Note.	Size of Grate. Inches.	Area of Grate. Square Feet.	Size of Smoke Pipe. Inches.	Outlets and Inlets. Inches.	List Price.
P 405	5	2400	40 x 33 $\frac{1}{8}$	9.55	18	2-5	\$ 810
P 406	6	3000	40 x 41 $\frac{1}{2}$	11.52	18	2-5	930
P 407	7	3600	40 x 49 $\frac{7}{8}$	13.85	18	2-5	1060
P 408	8	4200	40 x 58 $\frac{1}{4}$	16.18	18	2-5	1190
P 409	9	4800	40 x 66 $\frac{5}{8}$	18.50	18	2-5	1305
P 410	10	5400	40 x 75	20.82	18	2-5	1425
P 411	11	6000	40 x 83 $\frac{3}{8}$	23.13	18	2-5	1545
P 412	12	6600	40 x 91 $\frac{3}{4}$	25.50	18	2-5	1665
P 413	13	7200	40 x 91 $\frac{3}{4}$	25.50	18	2-5	1785
P 414	14	7800	40 x 91 $\frac{3}{4}$	25.50	18	2-5	1905
P 415	15	8400	40 x 91 $\frac{3}{4}$	25.50	18	2-5	2025

"MONARCH" WATER BOILERS "E" SERIES

P 405	5	3975	40 x 33 $\frac{1}{8}$	9.55	18	2-5	\$ 790
P 406	6	4950	40 x 41 $\frac{1}{2}$	11.52	18	2-5	910
P 407	7	5925	40 x 49 $\frac{7}{8}$	13.85	18	2-5	1040
P 408	8	6925	40 x 58 $\frac{1}{4}$	16.18	18	2-5	1170
P 409	9	7925	40 x 66 $\frac{5}{8}$	18.50	18	2-5	1285
P 410	10	8900	40 x 75	20.82	18	2-5	1405
P 411	11	9900	40 x 83 $\frac{3}{8}$	23.13	18	2-5	1525
P 412	12	10900	40 x 91 $\frac{3}{4}$	25.50	18	2-5	1645
P 413	13	11875	40 x 91 $\frac{3}{4}$	25.50	18	2-5	1765
P 414	14	12875	40 x 91 $\frac{3}{4}$	25.50	18	2-5	1885
P 415	15	13850	40 x 91 $\frac{3}{4}$	25.50	18	2-5	2005

*Note.—See pages 38 and 40 in regard to ratings.

SOFT COAL: A boiler one size larger is required when soft coal is used for fuel than would be used for hard coal.

Bridge wall sections are furnished for shortening grates, if desired, and are recommended for boilers above nine sections. They are regularly shipped with boilers larger than twelve sections, to reduce grate to length in table of dimensions.

For additional measurements, see page 36.

Do not bush outlets—connect full size to main.

MONARCH STEAM AND HOT WATER BOILERS

(PUSH NIPPLE TYPE)



"MONARCH" STEAM BOILERS "F" SERIES

Number of Boiler.	Number of Sections.	8-Hour Rating Square Feet. *Note.	Size of Grate. Inches.	Area of Grate. Square Feet.	Size of Smoke Pipe. Inches.	Outlets and Inlets. Inches.	List Price.
P 504	4	1200	28 x 24 $\frac{3}{4}$	4.82	12	2-5	\$460
P 505	5	1600	28 x 33 $\frac{1}{8}$	6.45	12	2-5	580
P 506	6	2000	28 x 41 $\frac{1}{2}$	8.07	12	2-5	700
P 507	7	2400	28 x 49 $\frac{7}{8}$	9.70	12	2-5	810
P 508	8	2800	28 x 58 $\frac{1}{4}$	11.32	12	2-5	900
P 509	9	3200	28 x 66 $\frac{5}{8}$	12.96	12	2-5	975

"MONARCH" WATER BOILERS "F" SERIES

P 504	4	1975	28 x 24 $\frac{3}{4}$	4.82	12	2-5	\$450
P 505	5	2625	28 x 33 $\frac{1}{8}$	6.45	12	2-5	570
P 506	6	3300	28 x 41 $\frac{1}{2}$	8.07	12	2-5	690
P 507	7	3950	28 x 49 $\frac{7}{8}$	9.70	12	2-5	800
P 508	8	4600	28 x 58 $\frac{1}{4}$	11.32	12	2-5	890
P 509	9	5275	28 x 66 $\frac{5}{8}$	12.96	12	2-5	965

*Note.—See pages 38 and 40 in regard to ratings.

SOFT COAL: A boiler one size larger is required when soft coal is used for fuel than would be used for hard coal.

For additional measurements, see page 36.

Do not bush outlets—connect full size to main.

MONARCH STEAM AND HOT WATER BOILERS

(PUSH NIPPLE TYPE)



"MONARCH" STEAM BOILERS "G" SERIES

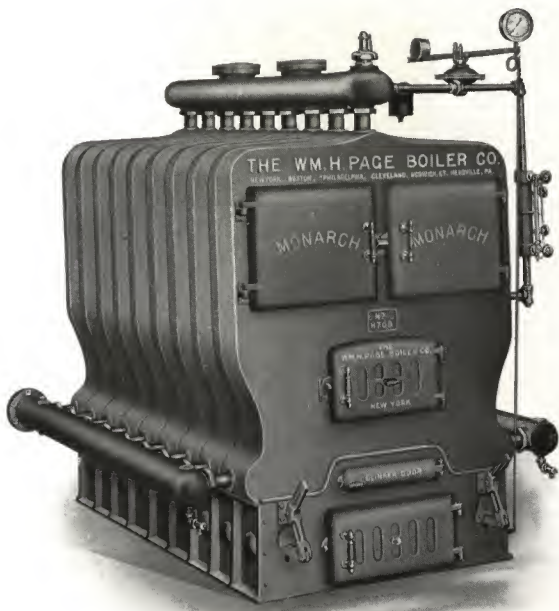
Number of Boiler.	Number of Sections.	8-Hour Rating Square Feet. *Note.	Size of Grate. Inches.	Area of Grate. Square Feet.	Size of Smoke Pipe. Inches.	Outlets and Inlets. Inches.	List Price.
P 604	4	650	22 x 20	3.35	10	2-3	\$280
P 605	5	850	22 x 26 $\frac{3}{8}$	4.03	10	2-3	355
P 606	6	1050	22 x 32 $\frac{3}{4}$	5.00	10	2-3	415
P 607	7	1250	22 x 39 $\frac{1}{8}$	5.98	10	2-3	475

"MONARCH" WATER BOILERS "G" SERIES

P 604	4	1075	22 x 20	3.35	10	2-3	\$270
P 605	5	1400	22 x 26 $\frac{3}{8}$	4.03	10	2-3	345
P 606	6	1725	22 x 32 $\frac{3}{4}$	5.00	10	2-3	405
P 607	7	2050	22 x 39 $\frac{1}{8}$	5.98	10	2-3	465

*Note.—See pages 38 and 40 in regard to ratings.
 SOFT COAL: A boiler one size larger is required when soft coal is used for fuel than would be used for hard coal.
 For additional measurements, see page 36.
 Do not bush outlets—connect full size to main.

MONARCH STEAM BOILER



Monarch Steam Boiler, Header Type

MONARCH STEAM AND HOT WATER BOILERS (HEADER TYPE)



"MONARCH" STEAM BOILERS "H" SERIES

Number of Boiler.	Number of Sections.	8-Hour Rating Square Feet. *Note.	Size of Grate. Inches.	Area of Grate. Square Feet.	Size of Smoke Pipe. Inches.	Outlets and Inlets. Inches.	List Price.
H 705	5	2400	40 x 33 $\frac{1}{8}$	9.55	18	2-5	\$ 810
H 706	6	3000	40 x 41 $\frac{1}{2}$	11.52	18	2-5	930
H 707	7	3600	40 x 49 $\frac{7}{8}$	13.85	18	2-5	1060
H 708	8	4200	40 x 58 $\frac{1}{4}$	16.18	18	2-5	1190
H 709	9	4800	40 x 66 $\frac{5}{8}$	18.50	18	2-5	1305
H 710	10	5400	40 x 75	20.82	18	2-5	1425
H 711	11	6000	40 x 83 $\frac{3}{8}$	23.13	18	2-5	1545
H 712	12	6600	40 x 91 $\frac{3}{4}$	25.50	18	2-5	1665

"MONARCH" WATER BOILERS "H" SERIES

H 705	5	3975	40 x 33 $\frac{1}{8}$	9.55	18	2-5	\$ 790
H 706	6	4950	40 x 41 $\frac{1}{2}$	11.52	18	2-5	910
H 707	7	5925	40 x 49 $\frac{7}{8}$	13.85	18	2-5	1040
H 708	8	6925	40 x 58 $\frac{1}{4}$	16.18	18	2-5	1170
H 709	9	7925	40 x 66 $\frac{5}{8}$	18.50	18	2-5	1285
H 710	10	8900	40 x 75	20.82	18	2-5	1405
H 711	11	9900	40 x 83 $\frac{3}{8}$	23.13	18	2-5	1525
H 712	12	10900	40 x 91 $\frac{3}{4}$	25.50	18	2-5	1645

*Note.—See pages 39 and 40 in regard to ratings.

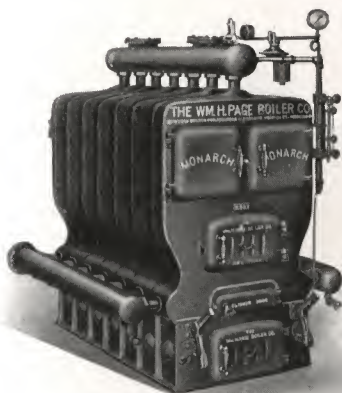
SOFT COAL: A boiler one size larger is required when soft coal is used for fuel than would be used for hard coal.

Bridge wall sections are furnished for shortening grates, if desired, and are recommended for boilers above nine sections.

For additional measurements, see page 37.

Do not bush outlets—connect full size to main.

MONARCH STEAM AND HOT WATER BOILERS (HEADER TYPE)



"MONARCH" STEAM BOILERS "I" SERIES

Number of Boiler.	Number of Sections.	8-Hour Rating Square Feet. * Note.	Size of Grate. Inches.	Area of Grate. Square Feet.	Size of Smoke Pipe. Inches.	Outlets and Inlets. Inches.	List Price.
H 804	4	1200	28 x 24 $\frac{3}{4}$	4.82	12	2-5	\$460
H 805	5	1600	28 x 33 $\frac{1}{8}$	6.45	12	2-5	580
H 806	6	2000	28 x 41 $\frac{1}{2}$	8.07	12	2-5	700
H 807	7	2400	28 x 49 $\frac{7}{8}$	9.70	12	2-5	810
H 808	8	2800	28 x 58 $\frac{1}{4}$	11.32	12	2-5	900
H 809	9	3200	28 x 66 $\frac{5}{8}$	12.96	12	2-5	975

"MONARCH" WATER BOILERS "I" SERIES

H 804	4	1975	28 x 24 $\frac{3}{4}$	4.82	12	2-5	\$450
H 805	5	2625	28 x 33 $\frac{1}{8}$	6.45	12	2-5	570
H 806	6	3300	28 x 41 $\frac{1}{2}$	8.07	12	2-5	690
H 807	7	3950	28 x 49 $\frac{7}{8}$	9.70	12	2-5	800
H 808	8	4600	28 x 58 $\frac{1}{4}$	11.32	12	2-5	890
H 809	9	5275	28 x 66 $\frac{5}{8}$	12.96	12	2-5	965

*Note.—See pages 39 and 40 in regard to ratings.

SOFT COAL: A boiler one size larger is required when soft coal is used for fuel than would be used for hard coal.

For additional measurements see page 37.

Do not bush outlets—connect full size to main.

MONARCH STEAM AND HOT WATER BOILERS

(HEADER TYPE)



"MONARCH" STEAM BOILERS "J" SERIES

Number of Boiler.	Number of Sections.	8-Hour Rating Square Feet. *Note.	Size of Grate. Inches.	Area of Grate. Square Feet.	Size of Smoke Pipe. Inches.	Outlets and Inlets. Inches.	List Price.
H 904	4	650	22 x 20	3.35	10	2-3	\$280
H 905	5	850	22 x 26 $\frac{3}{4}$	4.03	10	2-3	355
H 906	6	1050	22 x 32 $\frac{3}{4}$	5.00	10	2-3	415
H 907	7	1250	22 x 39 $\frac{1}{2}$	5.98	10	2-3	475

"MONARCH" WATER BOILERS "J" SERIES

H 904	4	1075	22 x 20	3.35	10	2-3	\$270
H 905	5	1400	22 x 26 $\frac{3}{4}$	4.03	10	2-3	345
H 906	6	1725	22 x 32 $\frac{3}{4}$	5.00	10	2-3	405
H 907	7	2050	22 x 39 $\frac{1}{2}$	5.98	10	2-3	465

*Note.—See pages 39 and 40 in regard to ratings.
 SOFT COAL: A boiler one size larger is required when soft coal is used for fuel than would be used for hard coal.
 For additional measurements see page 37.
 Do not bush outlets—connect full size to main.

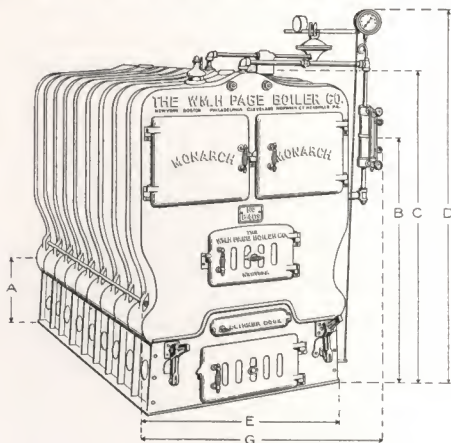
MONARCH WATER BOILER



Monarch Water Boiler, Header Type

MONARCH BOILER MEASUREMENTS

"E", "F", and "G" Series (Push Nipple)



"E" Series.

No.	A	B	C	D	E	G	H
P 405	19 $\frac{1}{4}$ "	50"	72 $\frac{1}{2}$ "	82 $\frac{1}{2}$ "	49"	60"	58"
P 406	19 $\frac{1}{4}$ "	59"	72 $\frac{1}{2}$ "	82 $\frac{1}{2}$ "	49"	60"	66 $\frac{3}{8}$ "
P 407	19 $\frac{1}{4}$ "	59"	72 $\frac{1}{2}$ "	82 $\frac{1}{2}$ "	49"	60"	74 $\frac{3}{4}$ "
P 408	19 $\frac{1}{4}$ "	59"	72 $\frac{1}{2}$ "	82 $\frac{1}{2}$ "	49"	60"	83 $\frac{1}{8}$ "
P 409	19 $\frac{1}{4}$ "	59"	72 $\frac{1}{2}$ "	82 $\frac{1}{2}$ "	49"	60"	91 $\frac{1}{2}$ "
P 410	19 $\frac{1}{4}$ "	59"	72 $\frac{1}{2}$ "	82 $\frac{1}{2}$ "	49"	60"	99 $\frac{7}{8}$ "
P 411	19 $\frac{1}{4}$ "	59"	72 $\frac{1}{2}$ "	82 $\frac{1}{2}$ "	49"	60"	108 $\frac{1}{4}$ "
P 412	19 $\frac{1}{4}$ "	59"	72 $\frac{1}{2}$ "	82 $\frac{1}{2}$ "	49"	60"	116 $\frac{5}{8}$ "
P 413	19 $\frac{1}{4}$ "	59"	72 $\frac{1}{2}$ "	82 $\frac{1}{2}$ "	49"	60"	125"
P 414	19 $\frac{1}{4}$ "	59"	72 $\frac{1}{2}$ "	82 $\frac{1}{2}$ "	49"	60"	133 $\frac{3}{8}$ "
P 415	19 $\frac{1}{4}$ "	59"	72 $\frac{1}{2}$ "	82 $\frac{1}{2}$ "	49"	60"	141 $\frac{3}{4}$ "

"F" Series.

P 504	19"	55"	64 $\frac{1}{2}$ "	74 $\frac{1}{2}$ "	36"	46"	49 $\frac{5}{8}$ "
P 505	19"	55"	64 $\frac{1}{2}$ "	74 $\frac{1}{2}$ "	36"	46"	58"
P 506	19"	55"	64 $\frac{1}{2}$ "	74 $\frac{1}{2}$ "	36"	46"	66 $\frac{3}{8}$ "
P 507	19"	55"	64 $\frac{1}{2}$ "	74 $\frac{1}{2}$ "	36"	46"	74 $\frac{3}{4}$ "
P 508	19"	55"	64 $\frac{1}{2}$ "	74 $\frac{1}{2}$ "	36"	46"	83 $\frac{1}{8}$ "
P 509	19"	55"	64 $\frac{1}{2}$ "	74 $\frac{1}{2}$ "	36"	46"	91 $\frac{1}{2}$ "

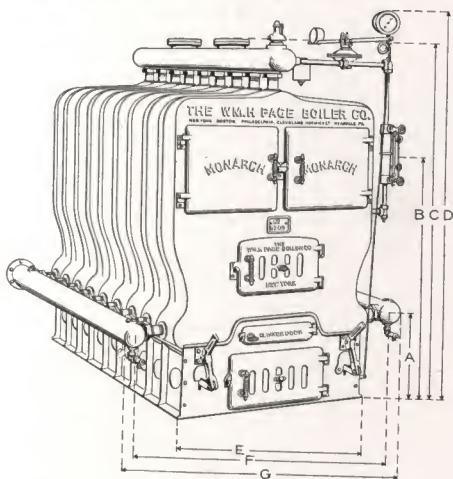
"G" Series.

P 604	16"	44"	52"	62"	29 $\frac{1}{2}$ "	38 $\frac{1}{2}$ "	40"
P 605	16"	44"	52"	62"	29 $\frac{1}{2}$ "	38 $\frac{1}{2}$ "	46 $\frac{3}{8}$ "
P 606	16"	44"	52"	62"	29 $\frac{1}{2}$ "	38 $\frac{1}{2}$ "	52 $\frac{3}{4}$ "
P 607	16"	44"	52"	62"	29 $\frac{1}{2}$ "	38 $\frac{1}{2}$ "	59 $\frac{1}{8}$ "

Dimension "A" is height from floor to centre of inlets.
Dimension "H" is extreme length.

MONARCH BOILER MEASUREMENTS

"H", "I", and "J" Series (Header)



"H" Series.

No.	A	B	C	D	E	F	G	H
H 705	19 1/4"	59"	82"	92"	49"	65 1/2"	75"	58"
H 706	19 1/4"	59"	82"	92"	49"	65 1/2"	75"	66 3/8"
H 707	19 1/4"	59"	82"	92"	49"	65 1/2"	75"	74 3/4"
H 708	19 1/4"	59"	82"	92"	49"	65 1/2"	75"	83 1/8"
H 709	19 1/4"	59"	82"	92"	49"	65 1/2"	75"	91 1/2"
H 710	19 1/4"	59"	82"	92"	49"	65 1/2"	75"	99 1/8"
H 711	19 1/4"	59"	82"	92"	49"	65 1/2"	75"	108 1/4"
H 712	19 1/4"	59"	82"	92"	49"	65 1/2"	75"	116 5/8"

"I" Series.

No.	A	B	C	D	E	F	G	H
H 804	19"	55"	76"	83"	36"	52 3/4"	61 3/4"	49 5/8"
H 805	19"	55"	76"	83"	36"	52 3/4"	61 3/4"	58"
H 806	19"	55"	76"	83"	36"	52 3/4"	61 3/4"	66 3/8"
H 807	19"	55"	76"	83"	36"	52 3/4"	61 3/4"	74 3/4"
H 808	19"	55"	76"	83"	36"	52 3/4"	61 3/4"	83 1/8"
H 809	19"	55"	76"	83"	36"	52 3/4"	61 3/4"	91 1/2"

"J" Series.

No.	A	B	C	D	E	F	G	H
H 904	16"	44"	61"	71"	29 1/2"	38 1/2"	44"	40"
H 905	16"	44"	61"	71"	29 1/2"	38 1/2"	44"	46 3/8"
H 906	16"	44"	61"	71"	29 1/2"	38 1/2"	44"	52 3/4"
H 907	16"	44"	61"	71"	29 1/2"	38 1/2"	44"	59 1/8"

Dimension "G" is extreme width of boiler measuring outside edge of flanges.
Dimension "H" is extreme length.

METHOD USED FOR ESTABLISHING RATINGS

(Derived from Actual Tests)

No. of Boiler.	A.—Fuel Available Anthracite Lbs.	B.—Rekindling Reserve Lbs.	C.—Adequate Fuel Charge, Lbs. (A + B)	D.—Steam Produced per Lb. Coal (Evaporative Power) Lbs.	E.—Total Steam Capacity Lbs. (Heating Power) (A X D)	F.—8-Hour Rating Square Feet.	G.—Area of Square Cornered Chimney Flue Square In.	H.—Height of Chimney Flue, Feet.
405	565	142	707	8.5	4800	2400	256	40
406	706	177	883	8.5	6000	3000	256	40
407	848	212	1060	8.5	7200	3600	324	50
408	990	248	1238	8.5	8400	4200	324	50
409	1130	283	1413	8.5	9600	4800	432	60
410	1272	318	1590	8.5	10800	5400	432	60
411	1412	353	1765	8.5	12000	6000	576	60
412	1553	389	1942	8.5	13200	6600	576	60
413	1694	424	2118	8.5	14400	7200	784	70
414	1835	459	2294	8.5	15600	7800	784	70
415	1977	495	2471	8.5	16800	8400	784	70
504	283	71	354	8.5	2406	1200	144	40
505	377	95	472	8.5	3205	1600	144	40
506	472	118	590	8.5	4012	2000	192	45
507	565	142	707	8.5	4803	2400	192	50
508	659	165	824	8.5	5602	2800	256	55
509	754	189	943	8.5	6409	3200	256	60
604	153	38	191	8.5	1301	650	96	35
605	200	50	250	8.5	1700	850	96	35
606	248	62	310	8.5	2108	1050	96	40
607	300	75	375	8.5	2550	1250	96	40

When load attached to boiler consists of direct radiation installed in a residence for 70°, the heat condensing power of the radiation and piping combined, rarely exceeds 0.25 (¼) lbs. of steam per square foot per hour.

The capacity of Page Monarch Boilers as indicated in the above table is determined on this basis and with anthracite coal containing 12,000 B.T.U. as fired.

If load attached to boiler has a condensing power exceeding 0.25, such as occurs in greenhouses, factories, etc., the factor representing the increased condensation should be used.

To establish 8-hour steam rating in square feet, divide the total steam capacity in pounds by 8 and divide by 0.25.

To establish rating for longer or shorter period divide total steam capacity by number of hours and divide by 0.25.

To determine hourly potential energy in B.T.U divide total steam capacity by 8 and multiply by the latent heat of evaporation, 970.

Hourly potential energy in B.T.U. divided by 240 for steam and 150 for water, gives 8-hour rating (which factors apply to house heating conditions only).

METHOD USED FOR ESTABLISHING RATINGS

(Derived from Actual Tests)

No. of Boiler.	A.—Fuel Available Anthracite Lbs.	B.—Rekindling Reserve Lbs.	C.—Adequate Fuel Charge, Lbs. (A+B)	D.—Steam Produced per Lb. Coal (Evaporative Power) Lbs.	E.—Total Steam Capacity Lbs. (Heating Power) (A×D)	F.—8-Hour Rating Square Feet.	G.—Area of Square Cornered Chimney Flue, Square In.	H.—Height of Chimney Flue, Feet.
705	565	142	707	8.5	4800	2400	256	40
706	706	177	883	8.5	6000	3000	256	40
707	848	212	1060	8.5	7200	3600	324	50
708	990	248	1238	8.5	8400	4200	324	50
709	1130	283	1413	8.5	9600	4800	432	60
710	1272	318	1590	8.5	10800	5400	432	60
711	1412	353	1765	8.5	12000	6000	576	60
712	1553	389	1942	8.5	13200	6600	576	60
804	283	71	354	8.5	2406	1200	144	40
805	377	95	472	8.5	3205	1600	144	40
806	472	118	590	8.5	4012	2000	192	45
807	565	142	707	8.5	4803	2400	192	50
808	659	165	824	8.5	5602	2800	256	55
809	754	189	943	8.5	6409	3200	256	60
904	153	38	191	8.5	1301	650	96	35
905	200	50	250	8.5	1700	850	96	35
906	248	62	310	8.5	2108	1050	96	40
907	300	75	375	8.5	2550	1250	96	40

When load attached to boiler consists of direct radiation installed in a residence for 70°, the heat condensing power of the radiation and piping combined, rarely exceeds 0.25 ($\frac{1}{4}$) lbs. of steam per square foot per hour.

The capacity of Page Monarch Boilers as indicated in the above table is determined on this basis and with anthracite coal containing 12,000 B.T.U. as fired.

If load attached to boiler has a condensing power exceeding 0.25, such as occurs in greenhouses, factories, etc., the factor representing the increased condensation should be used.

To establish 8-hour steam rating in square feet, divide the total steam capacity in pounds by 8 and divide by 0.25.

To establish rating for longer or shorter period divide total steam capacity by number of hours and divide by 0.25.

To determine hourly potential energy in B.T.U. divide total steam capacity by 8 and multiply by the latent heat of evaporation, 970.

Hourly potential energy in B.T.U. divided by 240 for steam and 150 for water gives 8-hour rating (which factors apply to house heating conditions only).

SPECIAL NOTICE

BOILER RATINGS

Boiler ratings as given are conservatively made according to accepted standards and are derived from careful and exhaustive tests which proved their safety, and are based on a standard of 2 lbs. pressure maintained at the boiler for steam, and 180 degrees for Hot Water.

All Piping (mains and risers, flows and returns) is to be figured as radiating surface in addition to the direct and indirect radiation attached to same.

Under Usual Conditions an allowance for piping and factor of safety is considered equal to approximately 50 per cent. of the net amount of direct radiators.

Sufficient Radiation must be installed to easily raise and maintain a temperature of 70 degrees.

Additional allowance must be made for use of direct-indirect, indirect radiation and contingencies as follows:

Direct-Indirect Radiators: Each foot of surface is considered equal to $1\frac{1}{3}$ ft. of direct radiation.

Indirect Radiators: Each foot of surface is considered equivalent to $1\frac{1}{2}$ ft. of direct radiation.

Coil or Water Back for warming water (domestic supply). Each gallon storage capacity is considered equivalent to 2 feet of direct steam radiators, or 3 feet of direct water radiators.

Boiler Covering.—Both on account of increased efficiency and greater economy, we recommend that all boilers be thoroughly protected by a substantial covering of asbestos.

Amount of Asbestos Cement required to cover any of our boilers may be estimated by allowing approximately 6 lbs. to the sq. ft. of surface to be covered— $1\frac{1}{4}$ inch thick.

GUARANTEE

Boilers are guaranteed only to the extent of furnishing new castings for any found defective in manufacture. All castings are thoroughly tested and subjected to a rigid inspection before leaving our works. On account of the varying conditions surrounding their installation, we do not guarantee our boilers except as above.

TERMS

Our terms are net 60 days, and subject only to cash discount of two per cent. 10 days from date of bill. All prices are subject to change or withdrawal without notice.

All goods are shipped at buyer's risk, and when we make delivery in good order to transportation companies, and obtain their receipt therefore, our responsibility ceases. Your recourse is, therefore, on the carrier. Examine all goods carefully before signing railroad receipt.

Goods must not be returned except by special permission, and when so returned will be subject to discount for rehandling.

DIRECTIONS FOR OPERATING ROUND OR SQUARE STEAM BOILERS

1.—**BEFORE STARTING** a fire in the Boiler see that the gauge glass is half full of water, also open the lower try-cock and see that it contains water. The gauge glass should always be about half full of water when the apparatus is in operation, and should the water by any means get below the gauge glass the fire should be drawn and the apparatus allowed to cool down before the water is turned on. If the water is attended to at the same time as the fire all trouble will be obviated.

2.—To start the fire, first close the check draft in smoke hood, then see that the hand damper in the smoke pipe is open.

3.—Open the draft door in ash pit sufficiently to get a good draft. Fill the fire pot full of dry kindling wood and when burning well, put on sufficient coal to cover the wood. As the wood continues to burn and the coal is fully ignited, fill the fire pot with coal. The damper regulator should then be adjusted so that the draft door in the ash pit is open and the check draft at the smoke hood closed, the damper regulator lever level, with no slack in either chain. The operation of the boiler can then be controlled by the weight on the lever.

The feed door should not be opened to regulate the temperature; this can be better accomplished by the use of the dampers, with more satisfactory results and greater economy of fuel. To "keep" fire, the draft dampers must be regulated to suit the draft of chimney; no rule can be laid down in this matter, as no two chimneys draw alike; consequently each apparatus must be regulated as experience teaches and the requirements call for.

4.—When it is desirable to check the fire and prevent the generating of steam, the chain can be unhooked from the damper in ash pit door, or the weights removed from the damper regulator.

5.—The fire should have attention during extremely cold weather at least three times a day. In moderate weather twice a day will be sufficient. This should be done early in the morning and late at night. To obtain good results the fire should be kept clean and perfectly free from ashes and clinkers. Keep the fire pot full of coal and the grate clear of ashes. In the morning after the fire has been cleaned, put on only enough coal to cover the fire. When this is burning freely, put on sufficient coal to fill the fire pot. Remove the ashes daily from the ash pit to avoid burning out the grates.

6.—**THE CLEAN-OUT DOORS** on the front and rear of the Boiler should be opened as often as necessary, to clean off any deposit which might form on the sections. A cleaning scraper is furnished with the boiler and the surfaces should be cleaned off at least once a month when the boiler is in use, or oftener, depending upon the quality of the fuel used. At all other times the clean-out doors should be kept closed.

7.—Occasionally pull lever of the safety valve to see that it opens easily.

Should all the water get out of the boiler, first dump the fire, open the fire door and let the boiler cool off, before refilling. If the apparatus is to be left without fire in cold weather, draw all the water off, to avoid freezing.

8.—**THE WATER** need not be drawn off from the apparatus during the summer months, and it is not necessary to renew the water in an apparatus oftener than once a year; the water should be drawn off and the apparatus refilled with fresh water just before starting the fire in the fall.

9.—See that the boiler has a separate flue and a good draft and at the beginning of each season have the smoke pipe cleaned and put in good order.

Use coal of good quality. As a rule stove size coal will give better results than any other.

10.—Have valves on the radiators either wide open or tightly closed. If partially open the radiators will draw the water from the heater.

11.—Unsatisfactory results may usually be traced to one or more of the following causes:

Insufficient quantity of radiating surface.

Improper pitch of pipes.

Obstruction in pipes caused by air or dirt.

Dip in the pipes, causing air pockets.

Insufficient size of heater.

Improper location of heater.

Improper firing.

Defective construction of chimney.

Imperfect draft of chimney.

Deposits of soot in chimney.

Want of attention.

Improper size and quality of coal.

More than one opening in heater flue.

DIRECTIONS FOR OPERATING ROUND OR SQUARE HOT WATER BOILERS

1.—**BEFORE STARTING** the fire see that the expansion tank contains water. As long as it can be seen in the gauge glass it is sufficient, but it is best to keep the glass half full of water, refilling it as often as necessary.

2.—**BUILD THE FIRE** in the usual way; use a good quality of coal, stove size preferably.

3.—**TO CONTROL THE FIRE** use the slide damper in ash pit door and the damper in smoke pipe. Open the fire door slide to supply air for perfect combustion. The fire door should not be opened to regulate the temperature; this can be better accomplished by the use of the dampers with more satisfactory results and greater economy of fuel. To "keep" fire, the draft dampers must be regulated to suit the draft of chimney; no rule can be laid down in this matter, as no two chimneys are alike, consequently each apparatus must be regulated as experience teaches and the requirements call for.

4.—**THE FIRE POT** should be kept full of coal (above the bottom of fire door) and all ashes and clinkers should be shaken down and removed as often as the state of the fire requires it.

5.—**SHAKE DOWN THE ASHES AND CLINKERS** by a front to rear motion of the upright shaker on the sectional Boilers or a right and left motion of the crank shaker on the Round Boilers. The Square Sectional Boilers are supplied with two shakers, operating each alternate Grate Bar.

6.—**HOT ASHES OR CINDERS** must not be allowed to remain in ash pit, under the grate bars, but should be removed to prevent burning out the grate bars.

7.—**THE CLEAN-OUT DOORS** on the front and rear of the Boiler should be opened as often as necessary to clean off any deposit which might form on the sections. A cleaning scraper is

furnished with the boiler, and the surfaces should be cleaned off at least once a month when the boiler is in use, or oftener, depending upon the quality of fuel used. At all other times, the clean-out doors should be kept closed.

8.—**THE WATER** need not be drawn off from the apparatus during the summer months, and it is not necessary to renew the water in an apparatus oftener than once a year; the water should be drawn off and the apparatus refilled with fresh water just before starting the fire in the fall.

9.—**IF THE BUILDING IS LEFT UNOCCUPIED** in cold weather, see that all the water is drawn out of the system. To do this it is necessary to open all the air valves, leaving them open until the system is refilled.

10.—**IN FILLING** the apparatus, open the air valves on the different radiators, to allow the air in the pipes to escape. Leave the air valves open until the water runs out, then close them tightly.

11.—**SHOULD ANY OF THE RADIATORS NOT CIRCULATE**, first see that the radiator valve is open, then open the air valve on the radiator affected until the water runs out, then close it tight. Always refill the expansion tank after drawing off water at the air valves.

12.—Unsatisfactory results may usually be traced to one or more of the following causes:

Insufficient quantity of radiating surface.

Improper pitch of pipes.

Obstruction in pipes caused by air or dirt.

Dip in the pipes, causing air pockets.

Insufficient size of heater.

Improper location of heater.

Improper firing.

Defective construction of chimney.

Imperfect draft of chimney.

Deposits of soot in chimney.

Want of attention.

Improper size and quality of coal.

More than one opening in heater flue.

VOLUNTEER WATER BACKS



These Water Backs are designed for use in our Volunteer and Monarch Boilers for heating water for domestic purposes in connection with range boiler.

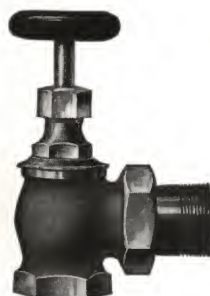
They are located in back of fire pot (in position shown in cut), for which openings are provided; cold water supply entering at bottom and hot water outlet from top opening. Are easily installed and very powerful heaters.

List Price

30 gal.....	\$3.00
40 gal.....	4.00
50 gal.....	5.00

JENKINS DISC STEAM RADIATOR VALVES

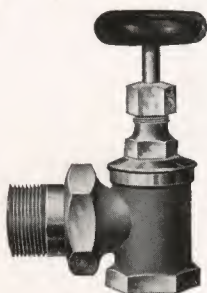
These valves are made of the best material; are heavy and well finished and full opening.



PRICE LIST

No.	SIZE	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2
1	Rough Body, with Union	\$2.75	3.50	4.30	5.85	7.75	12.60
2	Rough Body, Plated Trim., with Union..	3.00	3.75	4.65	6.25	8.00	12.80
3	*Rough Body, Plated all over, with Union	3.15	3.80	4.75	6.40	8.10	13.10
4	Finished Body, with Union	3.35	4.00	4.80	6.40	8.75	13.85
5	Finished Body, Plated all over, with Union	3.65	4.25	5.25	7.00	9.25	14.35

*Generally used.



QUICK OPENING HOT WATER RADIATOR VALVES

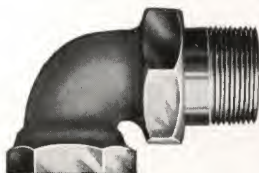
PRICE LIST

VALVES WITH UNION

No.	Size	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2
1	Rough Body, Finished Trimmings.....	\$2.05	\$2.45	\$3.25	\$4.50	\$6.50	\$10.00
2	*Rough Body, Plated all over	2.40	2.85	3.65	5.05	7.10	10.85
3	Finished Body, Plated all over	2.90	3.40	4.30	5.80	8.10	12.35

*Generally used.

UNION ELBOWS



PRICE LIST

No.	Size	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2
1	Rough, Plain	\$1.50	\$1.75	\$2.25	\$2.95	\$3.70	\$6.00
2	*Rough, Plated	1.75	2.00	2.50	3.20	4.00	7.00
3	Finished, Plain	2.00	2.20	2.75	3.60	4.60	7.50
4	Finished, Plated	2.25	2.45	3.00	3.85	4.90	8.50

*Generally used.



HOT WATER THERMOMETER

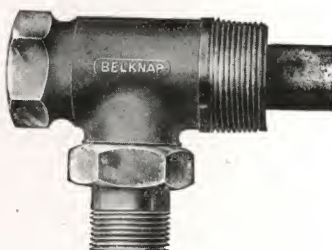
Accurately indicates the temperature of the water in a hot water heating apparatus.

It is unsurpassed for accuracy, sensitiveness, durability and practical construction.

Each thermometer guaranteed, and carefully packed and boxed.

List Price, \$3.00

CIRCULATING COUPLING



By the use of the Circulating Coupling it is only necessary to extend the risers directly through the floors to the valve and coupling, which avoids taking up floors and cutting joists as in the old way in order to extend the return pipes to the end of the radiator, and further effects a saving of four joints with the incidental labor and material, and minimizes the chance of leakage as well as reducing friction.

HOW CONNECTION IS MADE

The Circulating Coupling is screwed into the end of the radiator, the hot water valve being screwed into the coupling. The hot water passes from the valve through the tube in the coupling to the radiator; and cold (return) water passing out through the outer opening in the coupling between the tube and outer casing of the coupling to the return pipe, the operation causing a rapid circulation by agitation producing an even temperature through its entire surface.

RADIATORS SHOULD BE TAPPED

1 inch for $\frac{1}{2}$ inch coupling $1\frac{1}{4}$ for $\frac{3}{4}$ inch coupling $1\frac{1}{2}$ inch for 1 inch coupling
2 inch for $1\frac{1}{4}$ inch coupling 2 inch for $1\frac{1}{2}$ inch coupling

LIST PRICE

$\frac{1}{2}$ inch	$\frac{3}{4}$ inch	1 inch	$1\frac{1}{4}$ inch	$1\frac{1}{2}$ inch
\$2.50	\$2.80	\$3.70	\$4.50	\$5.35

VOLUNTEER AUTOMATIC AIR VALVES

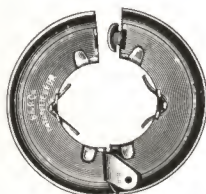
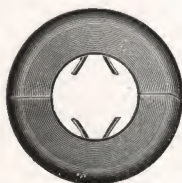


The expanding material used in our "Volunteer" Automatic Air Valves has been thoroughly tested. It does not deteriorate from use or age, and is fully warranted for five years. The frictionless corrugated float is used exclusively. This float cannot stick, and insures positive action. The expansion post is molded from Marsh's special formula composition of twenty-five years' test. The expanding post of the valve is reinforced by an inner brass tube, which holds the post absolutely straight, thus securing a perfect seat and prevents any possible injury to the valve.

List Price, each \$1.00

FLOOR AND CEILING PLATES

Beaton Pattern



Beaton Plates are made of pressed steel, nickel plated or of black finish, and can be easily put on the pipe after the work is finished by slipping the plate around the pipe, and are held firmly in place by a steel spring.

Size, Inches	$\frac{1}{2}$	$\frac{3}{4}$	1	$1\frac{1}{4}$	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4
Plain, each	\$.16	.17	.20	.22	.25	.30	.50	.65	.80	1.00
Nickel Plated, each	.27	.28	.32	.35	.38	.45	.65	.80	1.00	1.25

GALVANIZED EXPANSION TANKS

Our Tanks are made of refined galvanized steel, tested to one hundred pounds pressure. They have double riveted longitudinal seams and reinforced one inch outlets at top and bottom.



Capacity Gallons	Size Inches	Price of Tank	Price of Gauge	Sq. Foot Radiation
8	10 x 20	\$7.50	\$1.50	800
10	12 x 20	8.00	1.50	400
12	12 x 24	8.50	1.50	600
15	12 x 30	9.00	1.50	800
18	12 x 36	9.50	1.50	1000
20	14 x 30	12.50	1.50	1200
24	14 x 36	13.00	1.50	1500
26	16 x 30	14.00	1.50	1800
32	16 x 36	15.00	1.75	2300
42	16 x 48	16.50	1.75	3000

STEAM GAUGES

With Bourdon Spring



Size $3\frac{1}{2}$ and $4\frac{1}{2}$ inches, iron case, without back flange; brass rim; silvered dial; without cock. Registering 30 lbs. pressure.

In all respects as regularly supplied on our Steam Boilers.

These gauges are all equipped with hairspring tension, so the movement is rendered very sensitive at the lowest pressures under which house-heating boilers are usually operated—viz., 2 lbs. or less. We can also supply high-pressure gauges.

List Price, each \$3.00.

ALTITUDE GAUGES

These gauges will indicate accurately, at the boiler, the height of water in the system, and will be found very useful instruments.

Explanation: When the water is at its proper level in expansion tank, remove the ring and glass, and set the stationary hand at the pressure indicated by the working hand; whenever the pressure falls below this point, water should be added. Size $4\frac{1}{2}$ inches; iron case with brass rim; no cock.

List Price, each \$3.00.



BRONZE AND BRONZING LIQUID

As a result of repeated tests and experiments we have succeeded in obtaining a grade of bronze powder exactly suited for decorating steam and hot water radiators.

This bronze is our own direct importation and is of exceptional brilliancy and luster, which it retains when applied to hot surfaces, while most other kinds tarnish quickly.

A single trial will convince you of its superior quality and large covering capacity.

COLORS

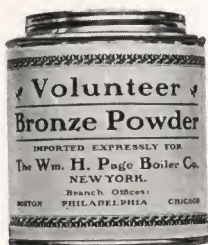
*Pale Gold	Lemon
Rich Gold	Orange
Copper	Crimson
Light Green	Scarlet
Dark Green	Fire

In Pound Cans

ALUMINUM

In Half Pound Cans

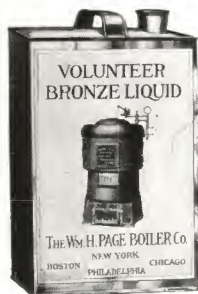
*Generally used.



BRONZING LIQUID

Our bronzing liquid, unlike all other, emits little or no odor when applied to hot surfaces, and is of the best quality.

It is as important to use a good bronzing liquid as a good bronze. Put up in gallon and half gallon cans.



TEMPERATURE "BOOSTER"



Plate No. 1
Temperature "Booster"

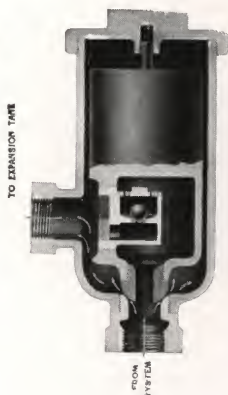


Plate No. 2
Showing Course Through
"Booster" to Expan-
sion Tank.

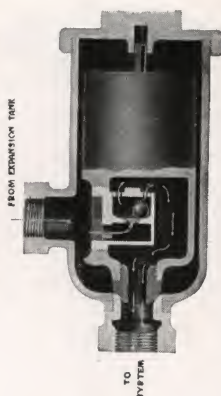


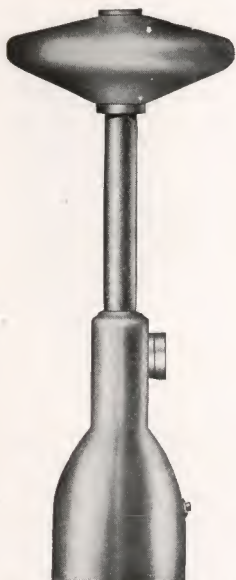
Plate No. 3
Showing Course
Through "Booster"
From Expansion Tank.

The temperature booster is a device which creates, by pressure, a quick and vigorous circulation of water in a hot water heating system. As soon as the water begins to warm, expansion takes place. The "Booster" confines the hot water to the system thus creating and maintaining a pressure until a total of 10 pounds plus that due to the elevation of the water is on the entire system. The water then passes to the expansion tank, as shown in plate No. 2, and when the temperature of the water in the system drops, it passes from the expansion tank to the system through the by-pass valve in the booster, as shown in plate No. 3. This operation is repeated as the temperature of the water rises and falls, thus constantly maintaining a pressure on the system.

Due to the increased pressure the flow of water is more rapid. It is passed through the boiler more frequently, requiring less heat units in a given time than the open tank or gravity system, resulting in a constant saving of fuel. The booster can be applied to old unsatisfactory heating systems, increasing their efficiency and saving the installation of a new boiler or an increase in radiation. On new systems less radiation and smaller pipes can be used than with the old style system, thus effecting a saving in labor and material costs.

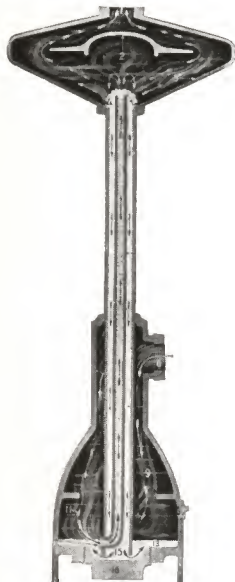
DIMENSIONS AND PRICES

Diameter.....	3 1/4"
Height.....	11 1/4"
Inlets and Outlets.....	1"
Price.....	\$14.00



HONEY- WELL HEAT GENERA- TORS

For Hot Water
Heating Outfits



These Generators are designed to meet the demand for a device to quicken the circulation in hot water heating jobs. When connected to the piping of an ordinary gravity plant this Generator seals the circuit and permits the generation of a slight pressure up to ten pounds, at which point it relieves itself through the operation of a mercury seal, eliminating the element of danger. The tendencies of this slight pressure are: first, to increase the circulation; second, to widen the range of temperatures to a point equal to that of steam; third, to accomplish an economy in fuel.

The pressure created by this Generator is calculated to force the water through any part of a defective piping system where the circulation is sluggish under ordinary gravity conditions. It is simple to install and is applicable to both old and new heating plants.

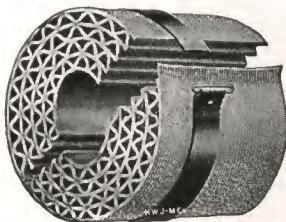
Sectional outline view herewith shows mercury seal, connections to system, equalizing pipe and deflecting plate.

Approximate weights: style 1, 35 lbs.; style 2, 45 lbs.; style 3, 55 lbs.

LIST PRICES, EACH

Style 1 for 1,200 square feet.	\$25.00
Style 2 for 2,500 square feet.	35.00
Style 3 for 3,500 square feet.	50.00

PIPE COVERING



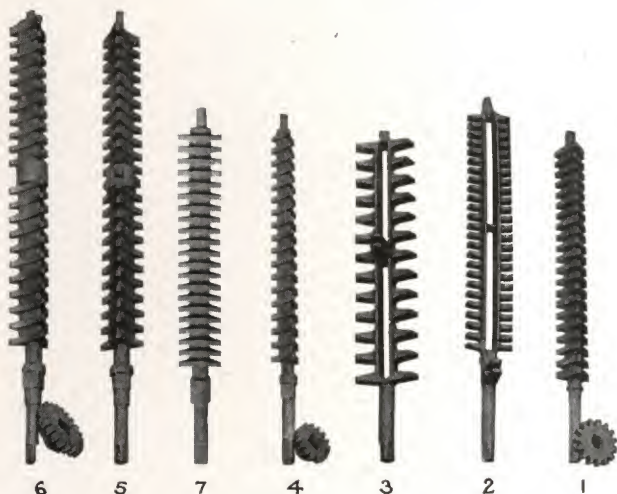
Sectional Pipe Covering

List below applies to all Sectional Pipe Coverings, 85 per cent. magnesia, wool felt, asbestos molded and asbestos air cell (subject to different discounts). These coverings are shipped in three foot sections furnished with canvas jackets and supplied with bands.

PRICE LIST

Inside Diam. of Pipe	Price per Lineal Foot	Elbows	Tees	Crosses	Globe Valves
$\frac{1}{2}$ inch	\$.22	\$.30	\$.36	\$.48	\$.54
$\frac{3}{4}$ "	.24	.30	.36	.48	.54
1 "	.27	.30	.36	.48	.54
$1\frac{1}{4}$ "	.30	.30	.36	.48	.54
$1\frac{1}{2}$ "	.33	.30	.36	.48	.54
2 "	.36	.36	.42	.54	.60
$2\frac{1}{2}$ "	.40	.42	.48	.60	.78
3 "	.45	.48	.54	.70	.96
$3\frac{1}{2}$ "	.50	.54	.60	.80	1.20
4 "	.60	.60	.75	.95	1.50
$4\frac{1}{2}$ "	.65	.72	.90	1.10	1.85
5 "	.70	.90	1.20	1.50	2.25
6 "	.80	1.30	1.60	2.00	2.80
7 "	1.00	1.80	2.20	2.80	3.60
8 "	1.10	2.40	3.00	3.60	4.40
9 "	1.20	3.00	3.80	4.40	5.30
10 "	1.30	3.60	4.60	5.20	6.20
12 "	1.85	....	....	....	....

STYLES OF GRATES FOR VOLUNTEER BOILERS



*Style No. 7 is the present style in use, having been adopted January 1st, 1909. It is a finer grate than the other styles and is suitable for all sizes of coal including pea.

The difference between styles No. 1 and No. 4 is in the surface of the bar (style No. 1 being flat, while style No. 4 is slightly concaved), and the former has gear with round opening while the latter has square opening.

The difference between styles No. 2 and No. 3 is in the width of the teeth as well as in location of toggle connection, style No. 2 being on the front end of bar while style No. 3 is in the center.

Style No. 5 is only used in our boilers with 30 and 36 inch grates and is same as style No. 6 without the bearing for grate bridge or support.

Style No. 6 is used in our boilers with 30 inch grate and above and is used in connection with grate bridge or support.

Be sure to advise the grate bar desired, counting from **left to right** as you face the boiler, and order by style number as per above cut. This will obviate mistakes and delays.

*Style No. 7 is interchangeable with styles No. 4 and No. 6 in all sizes of boilers up to and including No. 10. It is not adapted for No. 12 boiler made prior to 1909.

PRICE LIST OF PARTS FOR VOLUNTEER BOILERS

Name of Part.	Size:	0-1- 1 1/2-2	3-3 1/2- 4	5-5 1/2- 6	7-7 1/2- 8	9- 1/2 10	11 1/2 12	13 1/2- 14	15
Ashpit Casting Only....		\$16.00	\$19.00	\$22.00	\$25.00	\$34.00	\$40.00	\$55.00	\$55.00
“ Front.....		2.00	2.50	2.80	3.20	3.40	5.00	7.00	7.00
“ Door		2.00	2.50	2.60	2.80	3.00	4.00	5.00	5.00
“ Draft Door.....		1.50	1.50	1.70	1.80	2.00	2.50	3.00	3.00
“ Draft Door Slide		.50	.60	.70	.80	.90	1.00	1.10	1.10
Grate Rest (Front)....		.90	1.00	1.10	1.20	1.50	2.50	3.50	3.50
“ Bridge (Centre)	6.00	7.00	8.00	8.00
“ Gear.....		.20	.20	.20	.30	.40	.50	.60	.60
Ashpit Complete (Less									
Grates)		23.30	27.50	31.30	35.20	51.20	62.40	83.20	83.20
Grate Bar, No. 1, Style 7		1.25	1.60	2.00	2.20	2.30	2.90	7.00	7.00
“ “ “ 2 “		1.75	2.20	2.50	2.50	2.90	3.50	8.50	8.50
“ “ “ 3 “		1.75	2.20	2.50	2.80	2.90	5.60	9.00	9.00
“ “ “ 4 “		1.25	1.60	2.00	2.80	3.00	6.00	9.30	9.30
“ “ “ 5 “		2.50	2.90	5.60	9.00	9.00
“ “ “ 6 “		2.20	2.90	3.50	8.50	8.50
“ “ “ 7 “		2.30	2.90	7.00	7.00
Grates, Complete		6.00	7.60	9.00	15.00	19.20	30.00	58.30	58.30
Firepot		46.00	60.00	75.00	102.00	125.00	175.00	228.00	228.00
“ Door.....		2.00	2.00	2.00	2.00	2.00	2.50	4.00	4.00
“ “ Frame. . .		2.00	2.00	2.00	2.00	2.00	2.50	4.00	4.00
“ “ Handle . .		.40	.40	.40	.40	.40	.40	.60	.60
“ “ Slide.....		.40	.40	.40	.40	.40	.60	.80	.80
“ Complete.....		50.80	64.80	79.80	106.80	129.80	181.00	237.40	237.40
Closed Section.....		9.00	12.00	18.00	25.00	34.00	50.00	75.00	110.00
Open “		9.00	12.00	18.00	25.00	34.00	50.00	75.00	110.00
Steam Dome.....		36.00	40.00	48.00	60.00	84.00	112.00	180.00	240.00
H. W. Top Section.....		18.00	20.00	25.00	35.00	50.00	59.00	83.00	83.00
Nipple.....		1.00	1.00	1.20	1.30	1.30	1.50	2.00	2.00
Smoke Hood.....		4.00	4.00	5.00	6.00	6.50	8.00	9.00	13.00
“ “ Check Draft		.60	.60	.80	.80	.80	.90	1.00	1.50
Cold Air Check.....		2.50	2.50	3.00	3.50	3.50	4.00	6.00	6.00
“ “ “ Flap . .		.40	.40	.40	.70	.70	.80	.90	.90
“ “ “ Dog....		.40	.40	.40	.40	.40	.40	.40	.40
Water Column.....		2.00	2.00	2.00	2.00	2.00	2.00	2.50	2.50
Regulator Tank.....		5.00	5.00	5.00	5.00	5.00	5.00	10.00	10.00

PRICE LIST OF PARTS FOR VOLUNTEER BOILERS

Name of Part.	Size:	0-1- 1 1/2-2	3-3 1/2- 4	5-5 1/2- 6	7-7 1/2- 8	9-9 1/2- 10	11 1/2- 12	13 1/2- 14	15
Damper Regulator									
Complete..		\$5.00	\$5.00	\$6.00	\$6.00	\$6.00	\$6.00	\$7.00	\$7.00
" Yoke.....		.80	.80	.80	.80	.80	.80	.80	.80
" Pin.....		.40	.40	.40	.40	.40	.40	.40	.40
" Weight....		.50	.50	.50	.50	.50	.50	.50	.50
" Lever.....		.80	.80	.80	.80	.80	.80	.80	.80
" Rubber Dia- phragm.		1.00	1.00	1.00	1.20	.20	1.20	1.40	1.40
Water Gauge Set.....		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Tri Cock.....		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Gauge Cock.....		1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Gauge Glass.....		.40	.40	.40	.40	.40	.40	.40	.40
Safety Valve.....		3.00	3.00	3.00	3.60	4.00	5.00	7.00	7.00
Steam Gauge.....		3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Draw-off Cock.....		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Fire Tools.....		1.70	1.70	1.70	1.70	1.70	1.70	1.70	1.70
Flue Scraper.....		.50	.50	.50	.50	.50	.50	.50	.50
Shaker Handle.....		.80	.80	.80	.80	.80	.80	1.00	1.00
Fusible Plug.....		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

	Size:	No. 0	1	1 1/2	2	3	3 1/2	4	5
Jacket Panel.....		\$0.80	\$1.30	\$1.90	\$2.40	\$1.50	\$2.00	\$3.00	\$1.60
" C. O. Frame....		.60	.90	1.60	2.00	1.30	1.60	2.20	1.40
" C. O. Door.....		.60	.80	1.00	1.60	1.00	1.40	1.80	1.20
" Complete.....		4.00	6.00	9.00	12.00	7.60	10.00	14.00	10.00

	Size:	5 1/2	6	7	7 1/2	8	9	9 1/2	10
Jacket Panel.....		\$2.50	\$3.50	\$2.00	\$3.50	\$4.50	\$2.00	\$4.00	\$5.00
" C. O. Frame....		2.00	2.50	1.60	2.50	3.00	2.00	3.00	3.50
" C. O. Door.....		1.50	2.00	1.40	2.50	3.00	2.00	2.50	4.00
" Complete.....		14.50	19.50	12.00	20.50	25.50	14.00	23.00	30.00

	Size:	11 1/2	12	13 1/2	14	15			
Jacket Panel.....		\$5.50	\$7.00	\$5.50	\$8.00	\$10.00	....	....	....
" C. O. Frame....		4.00	4.00	3.50	4.50	6.00	....	....	....
" C. O. Door.....		2.50	3.50	3.50	3.50	4.00	....	....	....
" Complete.....		35.00	43.00	36.00	48.00	80.00	....	....	....

PRICE LIST OF PARTS FOR VOLUNTEER JUNIOR BOILERS

Name of Part	Size	No. 11	No. 15	No. 17	No. 19	No. 23
Ashpit (Casting Only).....		\$4.00	\$7.20	\$9.20	\$10.70	\$12.60
“ Grate Ring.....		3.20	4.20	4.80	5.40
“ Front.....		2.00	2.00	2.00	2.50	3.00
“ Door.....		1.50	2.00	2.00	2.50	3.00
“ Draft Door.....		1.00	1.00	1.00	1.50	1.50
“ “ “ Slide.....		.30	.30	.30	.40	.40
Grate Rest (Front).....	60	.70	.80	1.00
“ Gear.....	20	.20	.30	.40
Ashpit, Complete (Less Grates).....		8.80	16.30	19.40	23.20	26.90
Grate Bars, Each.....		1.00	1.50	1.80	2.00	2.60
Grates, Complete.....		3.80	6.00	7.20	8.00	10.40
Shaker Handle.....		.70	.80	.80	.80	.80
Fire Pot.....		25.00	35.00	44.00	58.00	75.00
“ “ Door.....		1.50	1.75	2.00	2.00	2.50
“ “ “ Frame.....		1.50	1.50	1.75	2.00	2.50
“ “ “ Slide.....		.30	.30	.30	.30	.30
“ “ “ Handle.....		.30	.30	.30	.30	.30
Clinker Door.....		.50	.50	.60	.60	.70
“ “ Frame.....		.80	.80	.90	.90	1.00
Fire Pot, Complete.....		29.90	40.15	49.85	64.10	82.30
H. W. Top Section.....		8.00	10.00	14.00	18.00	24.00
Steam Dome.....		17.00	20.00	25.00	37.00
Intermediate Section.....		10.00	12.00	16.00
Nipple.....		.60	.60	.70	.70	.80
Clean Out Door.....		.50	.60	.70	.70	.80
“ “ “ Frame.....		.30	.40	.50	.50	.60
Smoke Hood A.....		2.00	3.00	.....	4.00	.....
“ “ B C D E.....		1.50	2.00	3.00	4.00	5.00
“ “ Check Dratt.....		.50	.60	.60	.60	.70
“ “ Ratchet.....		.40	.40	.40	.40	.40
Water Column.....		2.00	2.00	2.00	2.00
“ Gauge Set, Complete.....		5.00	5.00	5.00	5.00
Tri Cock.....		1.00	1.00	1.00	1.00
Gauge Cock.....		1.50	1.50	1.50	1.50
“ Glass.....	40	.40	.40	.40
Steam Gauge.....		3.00	3.00	3.00	3.00
Safety Valve.....		3.00	3.00	3.00	3.00
Damper Regulator, Complete.....		5.00	5.00	5.00	5.00
“ “ Rubber Diaphragm.....		1.00	1.00	1.00	1.00
Tie Bolts, Per Set.....		.40	.60	.80	1.00	1.25
Flue Scraper.....		.50	.50	.50	.50	.50
Fusible Plug.....		1.00	1.00	1.00	1.00	1.00

PRICE LIST OF PARTS FOR MONARCH BOILERS

Name of Part	Series	E	F	G	H	I	J
Front Section		\$136.00	\$76.00	\$45.00	\$136.00	\$76.00	\$45.00
Back "		156.00	90.00	50.00	156.00	90.00	50.00
Intermediate Section		100.00	66.00	40.00	100.00	66.00	40.00
Bridge Wall Section		136.00	....	....	136.00	....	....
Smoke Hood, Complete		15.00	8.00	6.00	15.00	8.00	6.00
" " Check Draft		1.50	1.50	1.50	1.50	1.50	1.50
Push Nipple, (Top) . . . . .		.70	.60	.60	.70	.60	.60
" " (Bottom) . . . . .		.60	.60	.60	.60	.60	.60
Header— 4 Section	15.00	8.00
" — 5 "	17.00	17.00	9.00
" — 6 "	19.00	19.00	10.00
" — 7 "	22.00	22.00	12.00
" — 8 "	25.00	25.00	....
" — 9 "	28.00	28.00	....
" —10 "	31.00	....	....
" —11 "	34.00	....	....
" —12 "	37.00	....	....
" Flange	2.00	2.00	....
" Locknut50	.50	.40
" Nipple	1.40	1.40	1.00
Manifold— 4 Section	10.00	6.00
" — 5 "	12.00	12.00	7.00
" — 6 "	14.00	14.00	8.00
" — 7 "	16.00	16.00	9.00
" — 8 "	18.00	18.00	....
" — 9 "	20.00	20.00	....
" —10 "	22.00	....	....
" —11 "	24.00	....	....
" —12 "	26.00	....	....
" Flange	2.00	2.00	....
" Locknut40	.40	.30
" Nipple	1.20	1.20	.80
Ashpit Front		14.00	10.00	5.00	14.00	10.00	5.00
" Back		10.00	8.00	5.00	10.00	8.00	5.00
" Side—1 Section		4.00	4.00	....	4.00	4.00	....
" " —2 "		6.00	6.00	....	6.00	6.00	....
" " —3 "		8.00	8.00	....	8.00	8.00	....
" " —4 "		10.00	10.00	7.00	10.00	10.00	7.00
" " —5 "		12.00	12.00	8.00	12.00	12.00	8.00
" " —6 "		14.00	14.00	9.00	14.00	14.00	9.00
" " —7 "		16.00	16.00	10.00	16.00	16.00	10.00
" Cut Off		8.00	....	....	8.00	....	....
" Door		5.00	3.50	3.20	5.00	3.50	3.20
" " Slide		1.50	1.00	.90	1.50	1.00	.90
" " Handle . . . . .		.60	.60	.60	.60	.60	.60
" Draft Door		1.50	1.50	1.00	1.50	1.50	1.00
" Girt		1.50	1.00	1.00	1.50	1.00	1.00
Ashpit Rear Door		3.00	....	....	3.00	....	....
Grate Bar		10.00	7.00	5.00	10.00	7.00	5.00
" Rest End		2.50	2.30	2.00	2.50	2.30	2.00

PRICE LIST OF PARTS FOR MONARCH BOILERS

(Continued)

Name of Part	Series	E	F	G	H	I	J
Grate Rest Side— 4 Section	\$2.50	\$2.00	.....	\$2.50	\$2.00
“ “ “ — 5 “		\$3.00	3.00	2.50	\$3.00	3.00	2.50
“ “ “ — 6 “		4.00	4.00	3.00	4.00	4.00	3.00
“ “ “ — 7 “		4.50	4.50	3.50	4.50	4.50	3.50
“ “ “ — 8 “		5.00	5.00	....	5.00	5.00	....
“ “ “ — 9 “		5.50	5.50	....	5.50	5.50	....
“ “ “ —10 “		6.00	....	....	6.00	....	....
“ “ “ —11 “		6.50	....	....	6.50	....	....
“ “ “ —12 “		7.50	....	....	7.50	....	....
Grate Wheels.....		.30	.30	.30	.30	.30	.30
“ “ Holders.....		.50	.50	.50	.50	.50	.50
“ Toggle—Short.....		.80	.80	.80	.80	.80	.80
“ —Long.....		1.50	1.50	1.50	1.50	1.50	1.50
“ Shaker Lug.....		.50	.50	.50	.50	.50	.50
Shaker Lever.....		1.50	1.50	1.50	1.50	1.50	1.50
“ “ Socket.....		.80	.80	.80	.80	.80	.80
“ “ Bracket.....		.80	.80	.80	.80	.80	.80
Cleanout Door, Only.....		6.00	4.00	2.50	6.00	4.00	2.50
“ “ Lining.....		3.00	2.00	1.00	3.00	2.00	1.00
“ “ Handle.....		.60	.60	.60	.60	.60	.60
“ “ Hinge Lug.....		.40	.40	.40	.40	.40	.40
“ “ Catch Plate.....		.50	1.00	.80	.50	1.00	.80
Clinker Door, Only.....		1.50	1.20	1.00	1.50	1.20	1.00
“ “ Lining.....		1.00	.80	.80	1.00	.80	.80
“ “ Handle.....		.40	.40	.40	.40	.40	.40
Fire Door, Only.....		5.00	3.50	3.00	5.00	3.50	3.00
“ “ Lining.....		2.00	1.50	1.00	2.00	1.50	1.00
“ “ Slide.....		1.00	.80	.60	1.00	.80	.60
“ “ Handle.....		.60	.60	.60	.60	.60	.60
“ “ Hinge Lug.....		.40	.40	.40	.40	.40	.40
“ “ Catch.....		.40	.40	.40	.40	.40	.40
Damper Regulator, Complete....		8.00	8.00	6.00	8.00	8.00	6.00
Water Column.....		2.00	2.00	2.00	2.00	2.00	2.00
Water Gauge Set.....		5.00	5.00	5.00	5.00	5.00	5.00
Safety Valve.....		10.00	7.00	5.00	10.00	7.00	5.00
Steam Gauge.....		3.00	3.00	3.00	3.00	3.00	3.00
Fire Tools.....		4.00	4.00	1.70	4.00	4.00	1.70
Flue Brush.....		1.20	1.20	.80	1.20	1.20	.80
Tie Rods per Set— 4 Section.....		3.60	2.00	....	....	....
“ “ “ — 5 “		4.00	4.00	2.40	....	....	....
“ “ “ — 6 “		4.40	4.40	2.80	....	....	....
“ “ “ — 7 “		4.80	4.80	3.20	....	....	....
“ “ “ — 8 “		5.20	5.20	....	....	....	....
“ “ “ — 9 “		5.60	5.60	....	....	....	....
“ “ “ —10 “		6.00	....	....	....	....	....
“ “ “ —11 “		6.40	....	....	....	....	....
“ “ “ —12 “		6.80	....	....	....	....	....
“ “ “ —13 “		7.20	....	....	....	....	....
“ “ “ —14 “		7.60	....	....	....	....	....
“ “ “ —15 “		8.00	....	....	....	....	....

PRACTICAL INFORMATION FOR THE FITTER

Pertaining to Steam and Hot Water Heating

LOCATION OF HEATER

Locate the heater near the chimney whenever possible, and in such relation to it as to allow access to all its sides. Especial attention should be given to securing a good flue of ample capacity, with no other openings into it. The necessity of a good flue should be asserted, and furnishing same become a condition of all guarantees of the heater, likewise the use of proper fuel.

COAL

The greatest mistake in the selection of coal is usually using too large a size. The great majority of boilers will work better when using "stove" size anthracite coal than under any other conditions, as this size is so proportioned as to give proper amount of air space for good combustion. This is a very important question, in the solving of which many times depends a greater economy in operation. We recommend using either stove or egg size coals, according to the size of the fire pot.

CHIMNEY FLUES

The measure of the success and value of a heating system will be finally estimated by its relative efficiency and economy in use. A most important factor in such a system is a chimney flue having ample area, of proper form, height, location, and conditions. These factors are often overlooked by architects, owners, and contractors, the last of whom too often have to suffer the penalty of their indifference or disregard of the absolute requirements through a defaulting or unsatisfactory heating system.

The first consideration of a Heating Engineer in surveying premises for a heating plant should be the chimney and its adequacy to the work that will be required of it. An intelligent and conscientious engineer will ascertain the conditions that confront him at the outset, and in the order of most abundant fidelity will advise the owner at the time, rather than to rest and risk his reputation upon the stereotyped insertion in a contract, "the owner must provide a sufficient flue, having a good draft"—to encounter at a later time the criticisms of a disappointed owner, and possibly an utter defeat in his undertaking.

Chimney Flues should be of ample size and straight from near the cellar floor to above the highest projection of the roof. It should be absolutely independent and of sufficient area for passing sufficient air for the greatest consumption of fuel to be used. Less air will not do; more than is required will do no harm, as it will be within the power of the draft regulator to lessen it. A well-jointed tile flue, perfectly round is better than a brick flue of equal area. A square brick flue is preferable to a rectangular one, on account of the greater friction in the latter. Rectangular flues of extreme proportions, i. e., length to width, are very objectionable, as they often induce local currents up and down, which become a distraction.

The value of a flue depends on area and velocity. Velocity alone is no proof of good draft—there must be also sufficient area to carry the gases.

If there is a soot-pocket in the flue below the smoke-pipe opening, the clean-out door should always be tightly closed. If this soot-pocket has other openings in it—from fire-places or other connections—these openings check the draft and prevent best heating results from the Boiler.

The smoke-pipe should not extend into the flue beyond the inside surface of the flue, otherwise the end of the pipe cuts down the area of the flue.

The joints, where the smoke-pipe fits the smoke-hood of the boiler, or where the pipe enters the chimney, should be made tight with boiler putty or asbestos cement.

Flues of the proper area and height for boilers of various capacities will be found in tables on pages 16, 38 and 39.

PROPORTIONING RADIATION

FOR

STEAM AND WATER HEATING

Owing to the varying conditions surrounding the installation of heating apparatus, it is impossible to make any set rule apply without modification for all kinds of buildings to be heated. It is necessary to take into consideration all of the conditions in and around the building and addition to or deductions made to meet the requirements regardless of what rule may be used in estimating. Generally accepted rules are based on 2-pound steam pressure and a temperature of 180 degrees for water, as indicated at the boiler when the outside temperature is at zero. When systems are designed for heating with a lower temperature at the boiler (vapor, vacuum, etc.), it is necessary to provide additional radiation for different systems.

It is general practice to consider 70 degrees as the standard for inside temperature and zero for the outside. When there is a greater difference between the inside and outside temperature, 1% should be added to the radiation for each degree of difference.

Many contractors make the error of installing a too-small amount of radiation. A little additional surface will give greater economy and insure a first-class system, as well as a pleased owner. An apparatus of ample size can be regulated to give economy, which cannot be done if apparatus is too small and requires forcing.

The following rules have been found to give good results, but are not guaranteed.

FORMULAS FOR FIGURING DIRECT RADIATION BASED ON WALL AND GLASS EXPOSURES

JOHN H. MILLS: One square foot of radiating surface for each two square feet of glass, and for each twenty square feet of outside wall, and every two hundred cubic feet of space.

EXAMPLE:

Glass exposure, square feet, 60, 1 to 2=30
Wall outside, square feet, 210, 1 to 20=10½
Cubical contents, cubic feet, 2016, 1 to 200=10

Total 50½ sq. ft. st'm

For water, by generally accepted standards, add 60 per cent. equals 80 sq. ft. water.

PROF. R. C. CARPENTER, Cornell University: To the square feet of glass surface, add one quarter of the exposed wall surface, and 1-55 to 3-55 of cubical contents. (1-55 for rooms on upper floors, 2-55 for rooms on first floor, and 3-55 for large halls); then for steam multiply by .25; for water by .40.

EXAMPLE.—Room as above.

Glass exposure, 60 square feet, to which add one-quarter of wall $210 \div 4 = 52$, to which add (room first floor) $2-55$ cubical contents $- 2-55 \times 2016 = 73$. Thus $60 + 52 + 73 = 185 \times .25$ (for steam) = 46 square feet; or, $185 \times .40$ (for water) = 74 square feet.

DATA FOR INDIRECT RADIATION

Square Feet Rad. in Stack.	Square Inches Area Cold Air Duct First Floor.	Square Inches Area Warm Air Duct First Floor.	Square Inches Area Cold Air Duct Above First Floor.	Square Inches Area Warm Air Duct Above First Floor.	Rectangular Registers First Floor.	Rectangular Registers Above First Floor.	Radiator Tappings Hot Water.	Radiator Tappings Steam.
50	50	75	40	60	10x12	8x12	1¼ x 1¼	1¼ x 1
60	60	90	48	75	10x14	10x12	1¼ x 1¼	1¼ x 1
70	70	105	56	90	12x15	10x12	1½ x 1½	1¼ x 1
80	80	120	65	100	12x15	10x14	1½ x 1½	1¼ x 1
90	90	135	75	115	12x19	12x15	1½ x 1½	1½ x 1¼
100	100	150	85	130	12x19	12x15	2x2	1½ x 1¼

FOR HOT WATER, add 75 per cent. to what would be required for direct.

FOR STEAM, add 50 per cent. to what would be required for direct to ascertain the amount of indirect surface to be used as an equivalent of direct.

HANGING INDIRECT STACKS.—For cleanliness, as well as to obtain the best results, Indirect Stacks should be hung one side of the register or warm air flue opening, receiving the warm air from the end of the casing, and always at its top. The cold air duct should be on the opposite end and at the bottom of the casing. A space of ten inches (preferably twelve) should be allowed for warm air above the stack. The top of casing should pitch upward toward its exit at least one or more inches in its length. A space of six inches (preferably eight) should be allowed for cold air below stack.

In Hot Water indirect work it is not desirable to supply more than one hundred feet of radiation from one connection. When requirements are for large stacks they should be divided into two or more according to their sizes.

NOTE.—All indirect heating should be in connection with some system of ventilation, and therefore a larger volume of air must be warmed than when using direct radiation. When assigning indirect surface, due allowance must be made for it, and any excess of same provided for by increasing the amount of radiating surface.

HEATING AND VENTILATION

The respiration of one adult person will vitiate hourly about 500 cubic feet of air, to which should be added vitiation from other sources, such as moisture from the body, methods of illumination, etc., making a requirement of about 1,000 cubic feet per hour of fresh air for each adult person in average living rooms and places of assembly.

The atmosphere of rooms is changed partly by diffusion but chiefly and effectively by positive currents—the supply of fresh air through registers, connecting with the outside and becoming warmed as it passes over and through the intervening radiators—and the discharge of the foul air into flues provided for it. A common and most effective means in domestic ventilation is the chimney through an open fireplace, or a special flue in proximity to it rendered most effective by the incident heat of the chimney. The opening to this flue should be at the bottom, practically on a line with the floor.

The fresh air from the outside passes through registers at a velocity from 200 to 300 feet per minute. The clear openings of a register will be approximately two-thirds of its full area; thus a 12 by 15 register would have an available area of 120 inches. The fresh, warm air, passing at this rate per minute, would supply from 10,000 to 15,000 cubic feet an hour, and meet the requirements of a family of from 10 to 15 persons.

The requirements of Massachusetts Laws in the ventilation of school-rooms is 30 cubic feet of fresh air per minute for each pupil. Thus, the average room providing for 50 pupils would require 1,500 cubic feet per minute, or 90,000 cubic feet per hour. Contemplating a movement of the air at the rate of 5 feet per second, and supply and exhaust registers—2 by 2½ feet each—or an area of 5 square feet will insure the desired result.

For churches and general assembly halls, the requirement is 15 cubic feet per minute for each person.

SPECIFICATIONS OF MASSACHUSETTS FOR HEATING AND VENTILATING PUBLIC BUILDINGS, SCHOOLS, ETC.

1. That the apparatus will, with proper management, heat all the rooms, including corridors, to 70° in any weather.

2. That with the rooms at 70° and a difference of not less than 40° between the temperature of the outside air and that of the air entering the room at the warm air inlet, the apparatus will supply at least thirty cubic feet of air per minute for each scholar accommodated in the rooms.

3. That such supply of air will so circulate in the rooms that no uncomfortable draft will be felt, and that the difference in temperature between any two points on the breathing plane (5 ft.) in the occupied portion of a room will not exceed 3°.

4. That vitiated air in amount equal to supply from inlets will be removed through the vent ducts.

Tests are made by anemometer at both inlet and outlet registers to see that the requirements are fulfilled.

GREENHOUSE HEATING

While Greenhouses may be satisfactorily heated with Steam, Hot Water is generally preferred because of its ability to store large quantities of heat, and in case the fires are neglected or go out, this stored heat is given off gradually, and by preventing a sudden fall in temperature protects the plants from injury.

Table of Amounts of Radiating Surface Necessary to Heat a Given Amount of Glass Exposure to Various Temperatures in Zero Weather.

Square Feet of Glass Exposure	STEAM				
	No. of Square Feet of Radiation Required at				
	40°	45°	50°	60°	70°
25	2 7-9	3 1-8	3 4-7	4 1-6	5
50	5 5-9	6 1-4	7 1-7	8 1-3	10
75	8	9	10	13	15
100	11	13	14	17	20
200	23	25	30	33	40
300	34	38	43	50	60
400	45	50	57	67	80
500	56	63	72	83	100
1000	112	125	143	167	200
2000	223	250	286	333	400
3000	334	375	429	500	600
4000	445	500	571	667	800
5000	556	625	714	833	1000
10000	1112	1250	1429	1667	2000
20000	2223	2500	2857	3333	4000

Square Ft of Glass Exposure	HOT WATER				
	No. of Square Feet of Radiation Required at				
	40°	45°	50°	60°	70°
25	4 1-6	5	6 1-4	7 1-7	8 1-3
50	8	10	13	14	16
75	13	15	19	21	25
100	17	20	25	29	33
200	33	40	50	57	67
300	50	60	75	86	100
400	67	80	100	114	133
500	83	100	125	143	167
1000	167	200	250	286	333
2000	333	400	500	572	667
3000	500	600	750	857	1000
4000	667	800	1000	1143	1333
5000	833	1000	1250	1429	1667
10000	1667	2000	2500	2857	3333
20000	3333	4000	5000	5714	6667

For poorly constructed houses add 10 per cent. to the above amounts.

Do not use Asphalt or Tar Paints in a Greenhouse. They will injure the plants. Paint pipes with lampblack and boiled oil thinned with turpentine.

A most important part of a greenhouse is its chimney. This should be of brick or tile and of ample size, and should never be less than twenty-five feet high.

SIZES OF MAINS

STEAM, MAIN can be determined by taking the total amount of direct radiation to which add 25 per cent. for piping, and from this total extract the square root, dividing same by 10, which gives the size of main to use. This is for one-pipe work. For two-pipe work one size less is sufficient, and the return can be one or two sizes less than the supply. A steam main should not decrease in size according to the area of its branches, but very much slower.

ILLUSTRATION. Having 500 feet of direct radiation add to it 25 per cent. or 125, which equals 625. The square root of this is 25, which divided by 10 gives 2½, or the size of the pipe. For handy reference and practical use the following table can be used, though not exactly in accord with the foregoing.

SIZES OF STEAM MAINS

Radiation 125 square feet	One-pipe work	Two-pipe work
250 " "	1½ inch	1¼ x 1 inch
400 " "	2 " "	1½ x 1¼ "
650 " "	2½ " "	2 " x 1½ "
900 " "	3 " "	2½ x 2 "
1250 " "	3½ " "	3 " x 2½ "
1600 " "	4 " "	3½ x 3 "
2050 " "	4½ " "	4 " x 3½ "
2500 " "	5 " "	4½ x 4 "
3600 " "	6 " "	5 " x 4½ "
5000 " "	7 " "	6 " x 5 "
6500 " "	8 " "	7 " x 6 "
8100 " "	9 " "	8 " x 6 "
	10 " "	9 " x 6 "

SIZES OF HOT WATER MAINS

Radiation	Square Feet	Pipe
75 to 125	" "	1¼ inch
125 to 175	" "	1½ "
175 to 300	" "	2 "
300 to 475	" "	2½ "
475 to 700	" "	3 "
700 to 950	" "	3½ "
950 to 1200	" "	4 "
1200 to 1575	" "	4½ "
1575 to 1975	" "	5 "
1975 to 2375	" "	5½ "
2375 to 2850	" "	6 "

IN HOT WATER, FLOW MAINS may be reduced in size in proportion to the branches taken off. They should, however, have as large area as the sum of all branches beyond that point. It is advisable that the horizontal branches be one size larger than the risers. Returns should be same as flows.

TABLE OF MAINS AND BRANCHES

Main	Branch
1 in. will supply.....	2..... ¾ in.
1¼ in. " ".....	2..... 1 in.
1½ in. " ".....	2..... 1¼ in.
2 in. " ".....	2..... 1½ in.
2½ in. " ".....	2 1½ in. and 1 1¼ in., or 1 2 in. and 1 1¼ in.
3 in. " ".....	2 2½ in. and 1 2 in., or 2 2 in. and 1 1½ in.
3½ in. " ".....	2 2½ in. or 1 3 in., and 1 2 in. or 3 2 in.
4 in. " ".....	1 3½ in. and 1 2½ in., or 2 3 in. and 4 2 in.
4½ in. " ".....	1 3½ in. and 1 3 in., or 1 4 in. and 1 2½ in.
5 in. " ".....	1 4 in. and 1 3 in., or 1 4½ in. and 1 2½ in.
6 in. " ".....	2 4 in. and 1 3 in., or 4 3 in. or 10 2 in.
7 in. " ".....	1 6 in. and 1 4 in., or 3 4 in. and 1 2 in.
8 in. " ".....	2 6 in. and 1 5 in., or 5 4 in. and 2 2 in.

NUMBER OF GALLONS IN ROUND TANKS

Length or Depth in Feet	Diameter in Inches									
	18	24	30	36	42	48	54	60	66	72
2	26	47	73	105	144	188	238	294	356	424
2½	33	59	90	131	180	235	298	367	445	530
3	40	71	109	157	216	282	357	440	534	636
3½	47	83	127	183	252	329	416	513	623	742
4	54	95	145	209	288	376	475	586	712	848
4½	61	107	163	235	324	423	534	659	801	954
5	68	119	180	261	360	470	593	732	890	1060
5½	75	131	200	287	396	517	652	805	979	1166
6	82	143	217	313	432	564	711	878	1068	1272
6½	89	155	235	339	468	611	770	951	1157	1378
7	96	167	253	365	504	658	829	1024	1246	1484
7½	103	179	271	391	540	705	888	1097	1335	1590
8	110	191	289	417	576	752	947	1170	1424	1696
8½	...	203	307	443	612	799	1006	1243	1513	1802
10	...	239	361	521	720	940	1183	1462	1780	2120
12	...	287	433	625	864	1128	1419	1754	2136	2544
14	...	...	...	...	1008	1316	1655	2046	2492	2968
16	...	...	...	...	1152	1504	1891	2338	2848	3392
18	...	...	...	...	...	...	2127	2630	3204	3816
20	...	...	...	...	...	...	2363	2922	3560	4240

Note.—Above information is quoted from standard authorities. Not guaranteed.

CAPACITY OF RECTANGULAR TANKS

To find how many U. S. gallons any rectangular tank will hold: Multiply the inside length, depth and width which gives the contents of the tank in cubic inches, or in cubic feet as case may be. If in inches, divide by 1728 and you have the contents in cubic feet. Then multiply that result by 7.4805 (U. S. gallons in each cubic foot of water) and the final result is the number of U. S. gallons the tank will contain.

CAPACITY OF CYLINDRICAL TANKS

To find how many U. S. gallons a cylindrical tank will hold: Multiply the square of the inside diameter by 0.7854, which gives the area; multiply that result by the depth and this gives the cubic contents of the tank. If measurements are in inches, divide the cubic contents by 1728 and you then have contents expressed in cubic feet; then multiply by 7.4805 (U. S. gallons in each cubic foot of water) and the final result is the number of U. S. gallons the tank will contain.

COMPARATIVE COSTS OF HEATING BY ELECTRICITY, GAS AND COAL

The examples stated below will give any one an opportunity to determine the comparative costs of heating a building by electricity, gas, hard coal and soft coal, by employing the figures or costs of the fuels mentioned in his own locality.

HEATING BY ELECTRICITY

The heating value of one Kilowatt-hour is approximately 3,400 thermal units—therefore, at 10 cents per Kilowatt-hour, one cent will purchase 340 thermal units.

At \$7.00 per ton hard coal—making available about 8,000 thermal units per pound—one cent will purchase 22,857 thermal units. At this rate it would cost sixty-seven and two-tenths times as much to heat with electricity as with coal.

HEATING BY GAS

The available heating value of one cubic foot of gas for heating purposes is approximately 600 thermal units per cubic foot. At 50c per 1,000 cubic feet, one cent would purchase 12,000 thermal units.

With coal at \$7.00 per ton—as above—it would cost one and nine-tenths times as much to heat with gas as with hard coal.

With electricity and gas on the same basis—as above—but with soft coal—having a heating value of 6,000 thermal units per pound and selling at \$3.00 per ton—it would cost one hundred and seventeen times as much to heat with electricity as with soft coal—and three and three-tenths times as much to heat with gas as with soft coal.

AREAS OF CIRCLES

Size	Area	Size	Area	Size	Area	Size	Area
$\frac{1}{8}$	0.0123	10	78.54	30	706.86	65	3318.3
$\frac{1}{4}$	0.0491	$\frac{1}{2}$	86.59	31	754.76	66	3421.2
$\frac{3}{8}$	0.1104	11	95.03	32	804.24	67	3525.6
$\frac{1}{2}$	0.1963	$\frac{1}{2}$	103.86	33	855.30	68	3631.6
$\frac{5}{8}$	0.3067	12	113.09	34	907.92	69	3739.2
$\frac{3}{4}$	0.4417	$\frac{1}{2}$	122.71	35	962.11	70	3848.4
$\frac{7}{8}$	0.6013	13	132.73	36	1017.8	71	3959.2
1	0.7854	$\frac{1}{2}$	143.13	37	1075.2	72	4071.5
$\frac{1}{8}$	0.9940	14	153.93	38	1134.1	73	4185.3
$\frac{1}{4}$	1.227	$\frac{1}{2}$	165.13	39	1194.5	74	4300.8
$\frac{3}{8}$	1.484	15	176.71	40	1256.6	75	4417.8
$\frac{1}{2}$	1.767	$\frac{1}{2}$	188.69	41	1320.2	76	4536.4
$\frac{5}{8}$	2.073	16	201.06	42	1385.4	77	4656.0
$\frac{3}{4}$	2.405	$\frac{1}{2}$	213.82	43	1452.2	78	4778.3
$\frac{7}{8}$	2.761	17	226.98	44	1520.5	79	4901.6
2	3.141	$\frac{1}{2}$	240.52	45	1590.4	80	5026.5
$\frac{1}{4}$	3.976	18	254.46	46	1661.9	81	5153.0
$\frac{1}{2}$	4.908	$\frac{1}{2}$	268.80	47	1734.9	82	5281.0
$\frac{3}{4}$	5.939	19	283.52	48	1809.5	83	5410.6
3	7.068	$\frac{1}{2}$	298.64	49	1885.7	84	5541.7
$\frac{1}{4}$	8.295	20	314.16	50	1963.5	85	5674.5
$\frac{1}{2}$	9.621	$\frac{1}{2}$	330.06	51	2042.8	86	5808.8
$\frac{3}{4}$	11.044	21	346.36	52	2123.7	87	5944.6
4	12.566	$\frac{1}{2}$	363.05	53	2206.1	88	6082.1
$\frac{1}{2}$	15.904	22	380.13	54	2290.2	89	6221.1
5	19.635	$\frac{1}{2}$	397.60	55	2375.8	90	6361.7
$\frac{1}{2}$	23.758	23	415.47	56	2463.0	91	6503.8
6	28.274	$\frac{1}{2}$	433.73	57	2551.7	92	6647.6
$\frac{1}{2}$	33.183	24	452.39	58	2642.0	93	6792.9
7	38.484	$\frac{1}{2}$	471.43	59	2733.9	94	6939.7
$\frac{1}{2}$	44.178	25	490.87	60	2827.4	95	7088.2
8	50.265	26	530.93	61	2922.4	96	7238.2
$\frac{1}{2}$	56.745	27	572.55	62	3019.0	97	7389.8
9	63.617	28	615.75	63	3117.2	98	7542.9
$\frac{1}{2}$	70.882	29	660.52	64	3216.9	99	7697.7

To find the diameter of a circle when the circumference is given, multiply the given circumference by .3183

CIRCUMFERENCE OF CIRCLES

Size	Cmf.	Size	Cmf.	Size	Cmf.	Size	Cmf.
$\frac{1}{8}$	.3927	10	31.416	30	94.248	65	204.204
$\frac{1}{4}$	.7854	$\frac{1}{2}$	32.987	31	97.389	66	207.345
$\frac{3}{8}$	1.1781	11	34.558	32	100.531	67	210.487
$\frac{1}{2}$	1.5708	$\frac{1}{2}$	36.128	33	103.673	68	213.628
$\frac{5}{8}$	1.9635	12	37.699	34	106.814	69	216.770
$\frac{3}{4}$	2.3562	$\frac{1}{2}$	39.270	35	109.956	70	219.911
$\frac{7}{8}$	2.7489	13	40.841	36	113.097	71	223.053
1	3.1416	$\frac{1}{2}$	42.412	37	116.239	72	226.195
$\frac{1}{8}$	3.5343	14	43.982	38	119.381	73	229.336
$\frac{1}{4}$	3.9270	$\frac{1}{2}$	45.553	39	122.522	74	232.478
$\frac{3}{8}$	4.3197	15	47.124	40	125.664	75	235.619
$\frac{1}{2}$	4.7124	$\frac{1}{2}$	48.695	41	128.805	76	238.761
$\frac{5}{8}$	5.1051	16	50.265	42	131.947	77	241.903
$\frac{3}{4}$	5.4978	$\frac{1}{2}$	51.836	43	135.088	78	245.044
$\frac{7}{8}$	5.8905	17	53.407	44	138.230	79	248.186
2	6.2832	$\frac{1}{2}$	54.978	45	141.372	80	251.327
$\frac{1}{4}$	7.0686	18	56.549	46	144.513	81	254.469
$\frac{1}{2}$	7.8540	$\frac{1}{2}$	58.119	47	147.655	82	257.611
$\frac{3}{4}$	8.6394	19	59.690	48	150.796	83	260.752
3	9.4248	$\frac{1}{2}$	61.261	49	153.938	84	263.894
$\frac{1}{4}$	10.210	20	62.832	50	157.080	85	267.035
$\frac{1}{2}$	10.996	$\frac{1}{2}$	64.403	51	160.221	86	270.177
$\frac{3}{4}$	11.781	21	65.973	52	163.363	87	273.319
4	12.566	$\frac{1}{2}$	67.544	53	166.504	88	276.460
$\frac{1}{2}$	14.137	22	69.115	54	169.646	89	279.602
5	15.708	$\frac{1}{2}$	70.686	55	172.788	90	282.743
$\frac{1}{2}$	17.279	23	72.257	56	175.929	91	285.885
6	18.850	$\frac{1}{2}$	73.827	57	179.071	92	289.027
$\frac{1}{2}$	20.420	24	75.398	58	182.212	93	292.168
7	21.991	$\frac{1}{2}$	76.969	59	185.354	94	295.310
$\frac{1}{2}$	23.562	25	78.540	60	188.496	95	298.451
8	25.133	26	81.681	61	191.637	96	301.593
$\frac{1}{2}$	26.704	27	84.823	62	194.779	97	304.734
9	28.274	28	87.965	63	197.920	98	307.876
$\frac{1}{2}$	29.845	29	91.106	64	201.062	99	311.018

To find the circumference of a circle when diameter is given, multiply the given diameter by 3.1416.

HEATING SURFACE IN WROUGHT PIPE

Length of Pipe in ft.	SIZE OF PIPE									
	¾	1	1¼	1½	2	2½	3	4	5	6
1	.275	.346	.434	.494	.622	.753	.916	1.175	1.455	1.739
2	.5	.7	.9	1.	1.2	1.5	1.8	2.4	2.9	3.5
3	.8	1.	1.3	1.5	1.9	2.3	2.7	3.5	4.4	5.2
4	1.1	1.4	1.7	2.	2.5	3.	3.6	4.7	5.8	7.
5	1.4	1.7	2.2	2.4	3.1	3.8	4.6	5.8	7.3	7.7
6	1.6	2.1	2.6	2.9	3.7	4.5	5.5	7.	8.7	10.5
7	1.9	2.4	3.	3.4	4.4	5.3	6.4	8.2	10.2	12.1
8	2.2	2.8	3.5	3.9	5.	6.	7.3	9.4	11.6	13.9
9	2.5	3.1	3.9	4.4	5.6	6.8	8.2	10.6	13.1	15.7
10	2.7	3.5	4.3	4.9	6.2	7.5	9.1	11.8	14.6	17.4
11	3.	3.8	4.8	5.4	6.8	8.3	10.	12.9	16.	19.1
12	3.3	4.1	5.2	5.9	7.5	9.	11.	14.1	17.4	20.9
13	3.6	4.5	5.6	6.4	8.1	9.8	11.9	15.3	18.9	22.6
14	3.8	4.8	6.1	6.9	8.7	10.5	12.8	16.5	20.3	24.3
15	4.1	5.2	6.5	7.4	9.3	11.3	13.7	17.6	21.8	26.1
16	4.4	5.5	6.9	7.9	10.	12.	14.6	18.8	23.2	27.8
17	4.7	5.9	7.4	8.4	10.6	12.8	15.5	20.	24.7	29.5
18	5.	6.2	7.8	8.9	11.2	13.5	16.5	21.2	26.2	31.3
19	5.2	6.6	8.3	9.4	11.8	14.3	17.4	22.3	27.6	33.1
20	5.5	6.9	8.7	9.9	12.5	15.	18.3	23.5	29.1	34.8
25	6.9	8.6	10.9	12.3	15.6	18.8	22.9	29.3	36.3	43.5
30	8.3	10.4	13.	14.8	18.7	22.5	27.5	35.3	43.6	52.1
35	9.6	12.1	15.2	17.3	21.8	26.3	32.	41.1	50.9	60.8
40	11.	13.8	17.4	19.8	24.9	30.1	36.6	47.	58.2	69.5
45	12.4	15.6	19.5	22.2	28.	33.8	41.2	52.9	65.5	78.2
50	13.8	17.3	21.7	24.7	31.1	37.6	45.8	58.7	72.7	87.
55	15.2	19.0	23.9	27.1	34.3	41.3	50.4	64.6	80.1	95.6
60	16.6	20.8	26.0	29.6	37.3	45.2	55.	70.5	87.3	104.3
65	18.0	22.6	28.2	32.1	40.5	48.8	59.5	76.4	94.5	112.9
70	19.4	24.2	30.4	34.6	43.5	52.7	64.1	82.3	101.9	121.7
75	20.7	26.0	32.6	37.1	46.6	56.5	68.7	88.1	109.1	130.4
80	22.	27.7	34.7	39.6	49.8	60.2	73.3	94.0	116.4	139.1
85	23.4	29.4	36.9	42.0	53.4	63.9	77.8	99.9	123.7	147.9
90	24.8	31.1	39.1	44.5	56.	67.8	82.4	105.8	130.9	156.5
95	26.2	32.9	41.2	46.9	59.6	71.5	87.2	111.6	138.2	165.2
100	27.5	34.6	43.4	49.4	62.2	75.3	91.6	117.5	145.5	173.9

The above table will be found very convenient in estimating the amount of radiating surface in mains, etc.

CUBICAL CONTENTS OF ROOMS

HAVING CEILINGS OF THE FOLLOWING HEIGHTS

Floor	Area	8 ft.	8½ ft.	9 ft.	9½ ft.	10 ft.	10½ ft.	11 ft.	12 ft.
3	x 3	72	77	81	85	90	95	99	108
3	x 3½	84	89	95	99	105	110	115	124
3	x 4	96	102	108	114	120	126	132	144
3	x 4½	108	115	122	128	135	142	148	162
3	x 5	120	128	135	142	150	158	165	180
3	x 5½	132	140	149	156	165	173	181	198
3	x 6	144	153	162	171	180	189	198	216
3½	x 3½	98	104	110	116	123	129	134	147
3½	x 4	112	119	126	133	140	147	154	168
3½	x 4½	126	134	142	149	158	165	173	189
3½	x 5	140	149	158	166	175	184	192	210
3½	x 5½	154	164	173	182	193	202	211	231
3½	x 6	168	179	189	199	210	221	231	252
3½	x 6½	182	193	205	216	228	239	250	273
3½	x 7	196	208	221	232	245	257	269	294
4	x 4	128	136	144	152	160	168	176	192
4	x 4½	144	153	162	171	180	189	198	216
4	x 5	160	170	180	190	200	210	220	240
4	x 5½	176	187	198	209	220	231	242	264
4	x 6	192	204	216	228	240	252	264	288
4	x 6½	208	221	234	247	260	273	286	312
4	x 7	224	238	252	266	280	294	308	336
4	x 7½	240	255	270	285	300	315	330	360
4	x 8	256	272	288	304	320	336	352	384
4½	x 4½	162	172	182	192	203	213	222	243
4½	x 5	180	191	203	213	225	236	247	270
4½	x 5½	198	210	223	235	248	260	272	297
4½	x 6	216	230	243	256	270	284	297	324
4½	x 6½	234	249	263	277	293	307	321	351
4½	x 7	252	268	284	299	315	331	346	378
4½	x 7½	270	287	304	320	338	354	371	405
4½	x 8	288	306	324	342	360	378	396	432
4½	x 8½	306	325	344	363	383	402	420	459
4½	x 9	324	345	365	384	405	425	445	486
5	x 5	200	212	225	237	250	263	275	300
5	x 5½	220	234	248	261	275	289	302	330
5	x 6	240	255	270	285	300	315	330	360
5	x 6½	260	276	293	308	325	341	357	390
5	x 7	280	297	315	332	350	368	385	420
5	x 7½	300	319	338	358	375	394	412	450
5	x 8	320	340	360	380	400	420	440	480
5	x 8½	340	361	383	403	425	446	467	510
5	x 9	360	382	405	427	450	473	495	540
5	x 9½	380	404	428	451	475	499	522	570
5	x 10	400	425	450	475	500	525	550	600
5½	x 5½	242	257	272	287	303	318	332	363
5½	x 6	264	281	297	313	330	347	363	396
5½	x 6½	286	304	322	339	358	375	393	429
5½	x 7	308	327	347	365	385	404	423	462
5½	x 7½	330	351	371	391	413	433	453	495
5½	x 8	352	374	396	418	440	462	484	528
5½	x 8½	374	397	421	444	468	491	514	561
5½	x 9	396	421	446	470	495	520	544	594
5½	x 9½	418	444	470	496	523	549	574	627

CUBICAL CONTENTS OF ROOMS

HAVING CEILINGS OF THE FOLLOWING HEIGHTS

Floor	Area	8 ft.	8½ ft.	9 ft.	9½ ft.	10 ft.	10½ ft.	11 ft.	12 ft.
5½	x 10	440	468	495	522	550	578	605	660
5½	x 10½	462	491	520	548	578	606	635	693
5½	x 11	484	514	545	574	605	635	665	726
6	x 6	288	306	324	342	360	378	396	432
6	x 6½	312	332	351	370	390	410	429	468
6	x 7	336	357	378	399	420	441	462	504
6	x 7½	360	383	405	427	450	473	495	540
6	x 8	384	408	432	456	480	504	528	576
6	x 8½	408	434	459	484	510	536	561	612
6	x 9	432	459	486	513	540	567	594	648
6	x 9½	456	485	513	541	570	599	627	684
6	x 10	480	510	540	570	600	630	660	720
6	x 10½	504	536	567	598	630	662	693	756
6	x 11	528	561	594	627	660	693	726	792
6	x 11½	552	587	621	655	690	725	759	828
6	x 12	576	612	648	684	720	756	792	864
6½	x 6½	338	359	380	401	423	444	464	507
6½	x 7	364	387	410	432	455	478	500	546
6½	x 7½	390	414	439	463	488	512	536	585
6½	x 8	416	442	468	494	520	546	572	624
6½	x 8½	442	470	497	524	553	580	607	663
6½	x 9	468	497	527	555	585	615	643	702
6½	x 9½	494	525	556	586	618	648	679	741
6½	x 10	520	553	585	617	650	683	715	780
6½	x 10½	546	580	614	648	683	717	750	819
6½	x 11	572	608	644	679	715	751	786	858
6½	x 11½	598	635	673	710	748	785	822	897
6½	x 12	624	663	702	741	780	819	858	936
6½	x 12½	650	691	731	771	813	853	893	975
6½	x 13	676	718	761	802	845	887	929	1014
7	x 7	392	417	441	465	490	515	539	588
7	x 7½	420	446	473	498	525	551	577	630
7	x 8	448	476	504	532	560	588	616	672
7	x 8½	476	506	536	565	595	625	654	714
7	x 9	504	536	567	598	630	662	693	756
7	x 9½	532	565	599	631	665	698	731	798
7	x 10	560	595	630	665	700	735	770	840
7	x 10½	588	625	662	698	735	772	808	882
7	x 11	616	655	693	731	770	809	847	924
7	x 11½	644	684	725	764	805	845	885	966
7	x 12	672	714	756	798	840	882	924	1008
7	x 12½	700	744	788	831	875	919	962	1050
7	x 13	728	774	819	864	910	956	1001	1092
7	x 13½	756	803	851	897	945	992	1039	1134
7	x 14	784	833	882	931	980	1029	1078	1176
7½	x 7½	450	478	506	534	563	591	618	675
7½	x 8	480	510	540	570	600	630	660	720
7½	x 8½	510	542	574	605	638	669	701	765
7½	x 9	540	574	608	641	675	709	742	810
7½	x 9½	570	606	641	676	713	748	783	855
7½	x 10	600	638	675	712	750	788	825	900
7½	x 10½	630	669	709	748	788	827	866	945
7½	x 11	660	701	743	783	825	866	907	990
7½	x 11½	690	733	776	819	863	906	948	1035

CUBICAL CONTENTS OF ROOMS

HAVING CEILINGS OF THE FOLLOWING HEIGHTS

Floor	Area	8 ft.	8½ ft.	9 ft.	9½ ft.	10 ft.	10½ ft.	11 ft.	12 ft.
7½	x 12	720	765	810	855	900	945	990	1080
7½	x 12½	750	797	844	890	938	984	1031	1125
7½	x 13	780	829	878	926	975	1024	1072	1170
7½	x 13½	810	861	911	961	1013	1063	1113	1215
7½	x 14	840	893	945	997	1050	1103	1155	1260
7½	x 14½	870	924	979	1033	1088	1142	1196	1305
7½	x 15	900	956	1013	1068	1125	1181	1237	1350
8	x 8	512	544	576	608	640	672	704	768
8	x 8½	544	578	612	646	680	714	748	816
8	x 9	576	612	648	684	720	756	792	864
8	x 9½	608	646	684	722	760	798	836	912
8	x 10	640	680	720	760	800	840	880	960
8	x 10½	672	714	756	798	840	882	924	1008
8	x 11	704	748	792	836	880	924	968	1056
8	x 11½	736	782	828	874	920	966	1012	1104
8	x 12	768	816	864	912	960	1008	1056	1152
8	x 12½	800	850	900	950	1000	1050	1100	1200
8	x 13	832	884	936	988	1040	1092	1144	1248
8	x 13½	864	918	972	1026	1080	1134	1188	1296
8	x 14	896	952	1008	1064	1120	1176	1232	1344
8	x 14½	928	986	1044	1102	1160	1218	1276	1392
8	x 15	960	1020	1080	1140	1200	1260	1320	1440
8	x 15½	992	1054	1116	1178	1240	1302	1364	1488
8	x 16	1024	1088	1152	1216	1280	1344	1408	1536
8½	x 8½	578	614	650	686	723	759	794	867
8½	x 9	612	650	689	726	765	803	841	918
8½	x 9½	646	686	727	767	808	848	888	969
8½	x 10	680	723	765	807	850	893	935	1020
8½	x 10½	714	759	803	847	893	937	981	1071
8½	x 11	748	795	842	888	935	982	1028	1122
8½	x 11½	782	831	880	928	978	1026	1075	1173
8½	x 12	816	867	918	969	1020	1071	1122	1224
8½	x 12½	850	903	956	1009	1063	1116	1168	1275
8½	x 13	884	939	995	1049	1105	1160	1215	1326
8½	x 13½	918	975	1033	1090	1148	1205	1262	1377
8½	x 14	952	1012	1071	1130	1190	1250	1309	1428
8½	x 14½	986	1048	1109	1170	1233	1294	1355	1479
8½	x 15	1020	1084	1148	1211	1275	1339	1402	1530
8½	x 15½	1054	1120	1186	1251	1318	1383	1449	1581
8½	x 16	1088	1156	1224	1292	1360	1428	1496	1632
8½	x 16½	1122	1192	1262	1332	1403	1473	1542	1683
8½	x 17	1156	1228	1301	1372	1445	1517	1589	1734
9	x 9	648	689	729	769	810	851	891	972
9	x 9½	684	727	770	812	855	898	940	1026
9	x 10	720	765	810	855	900	945	990	1080
9	x 10½	756	803	851	897	945	992	1039	1134
9	x 11	792	842	891	940	990	1040	1089	1188
9	x 11½	828	880	932	982	1035	1087	1138	1242
9	x 12	864	918	972	1026	1080	1134	1188	1296
9	x 12½	900	956	1013	1068	1125	1181	1237	1350
9	x 13	936	995	1053	1111	1170	1229	1287	1404
9	x 13½	972	1033	1094	1154	1215	1276	1336	1458
9	x 14	1008	1071	1134	1197	1260	1323	1386	1512
9	x 14½	1044	1109	1175	1239	1305	1370	1435	1566

CUBICAL CONTENTS OF ROOMS

HAVING CEILINGS OF THE FOLLOWING HEIGHTS

Floor	Area	8 ft.	8½ ft.	9 ft.	9½ ft.	10 ft.	10½ ft.	11 ft.	12 ft.
9	x 15	1080	1148	1215	1282	1350	1418	1485	1620
9	x 15½	1116	1186	1256	1325	1395	1465	1534	1674
9	x 16	1152	1224	1296	1368	1440	1512	1584	1728
9	x 16½	1188	1262	1337	1410	1485	1559	1633	1782
9	x 17	1224	1301	1377	1453	1530	1607	1683	1836
9	x 17½	1260	1339	1418	1496	1575	1654	1732	1890
9	x 18	1296	1377	1458	1539	1620	1701	1782	1944
9½	x 9½	722	767	812	857	903	948	992	1083
9½	x 10	760	808	855	902	950	998	1045	1140
9½	x 10½	798	848	898	947	998	1047	1097	1197
9½	x 11	836	888	940	992	1045	1097	1149	1254
9½	x 11½	874	929	983	1038	1093	1147	1201	1311
9½	x 12	912	969	1026	1083	1140	1197	1254	1368
9½	x 12½	950	1009	1069	1128	1188	1247	1306	1425
9½	x 13	988	1050	1111	1173	1235	1297	1358	1482
9½	x 13½	1026	1090	1154	1218	1283	1347	1410	1539
9½	x 14	1064	1131	1197	1263	1330	1397	1463	1596
9½	x 14½	1102	1171	1240	1308	1378	1446	1515	1653
9½	x 15	1140	1211	1282	1353	1425	1496	1567	1710
9½	x 15½	1178	1252	1325	1398	1473	1546	1619	1767
9½	x 16	1216	1292	1368	1444	1520	1596	1672	1824
9½	x 16½	1254	1332	1411	1489	1568	1646	1724	1881
9½	x 17	1292	1373	1453	1534	1615	1696	1776	1938
9½	x 17½	1330	1413	1496	1579	1663	1746	1828	1995
9½	x 18	1368	1454	1539	1624	1710	1796	1881	2052
9½	x 18½	1406	1494	1582	1669	1758	1845	1933	2109
9½	x 19	1444	1534	1625	1714	1805	1895	1985	2166
10	x 10	800	850	900	950	1000	1050	1100	1200
10	x 10½	840	893	945	997	1050	1103	1155	1260
10	x 11	880	935	990	1045	1100	1155	1210	1320
10	x 11½	920	978	1035	1092	1150	1208	1265	1380
10	x 12	960	1020	1080	1140	1200	1260	1320	1440
10	x 12½	1000	1063	1125	1187	1250	1313	1375	1500
10	x 13	1040	1105	1170	1235	1300	1365	1430	1560
10	x 13½	1080	1148	1215	1282	1350	1418	1485	1620
10	x 14	1120	1190	1260	1330	1400	1470	1540	1680
10	x 14½	1160	1233	1305	1377	1450	1523	1595	1740
10	x 15	1200	1275	1350	1425	1500	1575	1650	1800
10	x 15½	1240	1318	1395	1472	1550	1628	1705	1860
10	x 16	1280	1360	1440	1520	1600	1680	1760	1920
10	x 16½	1320	1403	1485	1567	1650	1733	1815	1980
10	x 17	1360	1445	1530	1615	1700	1785	1870	2040
10	x 17½	1400	1488	1575	1662	1750	1838	1925	2100
10	x 18	1440	1530	1620	1710	1800	1890	1980	2160
10	x 18½	1480	1573	1665	1757	1850	1943	2035	2220
10	x 19	1520	1615	1710	1805	1900	1995	2090	2280
10	x 19½	1560	1658	1755	1852	1950	2048	2145	2340
10	x 20	1600	1700	1800	1900	2000	2100	2200	2400
11	x 11	968	1029	1089	1149	1210	1271	1331	1452
11	x 12	1056	1122	1188	1254	1320	1386	1452	1584
11	x 13	1144	1216	1287	1358	1430	1502	1573	1716
11	x 14	1232	1309	1386	1463	1540	1617	1694	1848
11	x 15	1320	1403	1485	1567	1650	1733	1815	1980
11	x 16	1408	1496	1584	1672	1760	1848	1936	2112

CUBICAL CONTENTS OF ROOMS

HAVING CEILINGS OF THE FOLLOWING HEIGHTS

Floor	Area	8 ft.	8½ ft.	9 ft.	9½ ft.	10 ft.	10½ ft.	11 ft.	12 ft.
11	x 17	1496	1590	1683	1776	1870	1964	2057	2244
11	x 18	1584	1683	1782	1881	1980	2079	2178	2376
11	x 19	1672	1777	1881	1986	2090	2195	2299	2508
11	x 20	1760	1870	1980	2090	2200	2310	2420	2640
11	x 21	1848	1964	2079	2194	2310	2426	2541	2772
11	x 22	1936	2057	2178	2299	2420	2541	2662	2904
12	x 12	1152	1224	1296	1368	1440	1512	1584	1728
12	x 13	1248	1326	1404	1482	1560	1638	1716	1872
12	x 14	1344	1428	1512	1596	1680	1764	1848	2016
12	x 15	1440	1530	1620	1710	1800	1890	1980	2160
12	x 16	1536	1632	1728	1824	1920	2016	2112	2304
12	x 17	1632	1734	1836	1938	2040	2142	2244	2448
12	x 18	1728	1836	1944	2052	2160	2268	2376	2592
12	x 19	1824	1938	2052	2166	2280	2394	2508	2736
12	x 20	1920	2040	2160	2280	2400	2520	2640	2880
12	x 21	2016	2142	2268	2394	2520	2646	2772	3024
12	x 22	2112	2244	2376	2508	2640	2772	2904	3168
12	x 23	2208	2346	2484	2622	2760	2898	3036	3312
12	x 24	2304	2448	2592	2736	2880	3024	3168	3456
13	x 13	1352	1437	1521	1605	1690	1775	1859	2028
13	x 14	1456	1547	1638	1729	1820	1911	2002	2184
13	x 15	1560	1658	1755	1852	1950	2048	2145	2340
13	x 16	1664	1768	1872	1976	2080	2184	2288	2496
13	x 17	1768	1879	1989	2099	2210	2321	2431	2652
13	x 18	1872	1989	2106	2223	2340	2457	2574	2808
13	x 19	1976	2100	2223	2346	2470	2594	2717	2964
13	x 20	2080	2210	2340	2470	2600	2730	2860	3120
13	x 21	2184	2321	2457	2593	2730	2867	3003	3276
13	x 22	2288	2431	2574	2717	2860	3003	3146	3432
13	x 23	2392	2542	2691	2840	2990	3140	3289	3588
13	x 24	2496	2652	2808	2964	3120	3276	3432	3744
13	x 25	2600	2763	2925	3087	3250	3413	3575	3900
13	x 26	2704	2873	3042	3211	3380	3549	3718	4056
14	x 14	1568	1666	1764	1862	1960	2058	2156	2352
14	x 15	1680	1785	1890	1995	2100	2205	2310	2520
14	x 16	1792	1904	2016	2128	2240	2352	2464	2688
14	x 17	1904	2023	2142	2261	2380	2499	2618	2856
14	x 18	2016	2142	2268	2394	2520	2646	2772	3024
14	x 19	2128	2261	2394	2527	2660	2793	2926	3192
14	x 20	2240	2380	2520	2660	2800	2940	3080	3360
14	x 21	2352	2499	2646	2793	2940	3087	3234	3528
14	x 22	2464	2618	2772	2926	3080	3234	3388	3696
14	x 23	2576	2737	2898	3059	3220	3381	3542	3864
14	x 24	2688	2856	3024	3192	3360	3528	3696	4032
14	x 25	2800	2975	3150	3325	3500	3675	3850	4200
14	x 26	2912	3094	3276	3458	3640	3822	4004	4368
14	x 27	3024	3213	3402	3591	3780	3969	4158	4536
14	x 28	3136	3332	3528	3724	3920	4116	4312	4704
15	x 15	1800	1913	2025	2137	2250	2363	2475	2700
15	x 16	1920	2040	2160	2280	2400	2520	2640	2880
15	x 17	2040	2168	2295	2422	2550	2678	2805	3060
15	x 18	2160	2295	2430	2565	2700	2835	2970	3240
15	x 19	2280	2423	2565	2707	2850	2993	3135	3420
15	x 20	2400	2550	2700	2850	3000	3150	3300	3600

CUBICAL CONTENTS OF ROOMS

HAVING CEILINGS OF THE FOLLOWING HEIGHTS

Floor Area			8 ft.	8½ ft.	9 ft.	9½ ft.	10 ft.	10½ ft.	11 ft.	12 ft.
15	x	21	2520	2678	2835	2992	3150	3308	3465	3780
15	x	22	2640	2805	2970	3135	3300	3465	3630	3960
15	x	23	2760	2933	3105	3277	3450	3623	3795	4140
15	x	24	2880	3060	3240	3420	3600	3780	3960	4320
15	x	25	3000	3188	3375	3562	3750	3938	4125	4500
15	x	26	3120	3315	3510	3705	3900	4095	4290	4680
15	x	27	3240	3443	3645	3847	4050	4253	4455	4860
15	x	28	3360	3570	3780	3990	4200	4410	4620	5040
15	x	29	3480	3698	3915	4132	4350	4568	4785	5220
15	x	30	3600	3825	4050	4275	4500	4725	4950	5400
16	x	16	2048	2176	2304	2432	2560	2688	2816	3072
16	x	17	2176	2312	2448	2584	2720	2856	2992	3264
16	x	18	2304	2448	2592	2736	2880	3024	3168	3456
16	x	19	2432	2584	2736	2888	3040	3192	3344	3648
16	x	20	2560	2720	2880	3040	3200	3360	3520	3840
16	x	21	2688	2856	3024	3192	3360	3528	3696	4032
16	x	22	2816	2992	3168	3344	3520	3696	3872	4224
16	x	23	2944	3128	3312	3496	3680	3864	4048	4416
16	x	24	3072	3264	3456	3648	3840	4032	4224	4608
16	x	25	3200	3400	3600	3800	4000	4200	4400	4800
16	x	26	3328	3536	3744	3952	4160	4368	4576	4992
16	x	27	3456	3672	3888	4104	4320	4536	4752	5184
16	x	28	3584	3808	4032	4256	4480	4704	4928	5376
16	x	29	3712	3944	4176	4408	4640	4872	5104	5568
16	x	30	3840	4080	4320	4560	4800	5040	5280	5760
16	x	31	3968	4216	4464	4712	4960	5208	5456	5952
16	x	32	4096	4352	4606	4864	5120	5376	5632	6144
18	x	18	2592	2754	2916	3078	3240	3402	3564	3888
18	x	20	2880	3060	3240	3420	3600	3780	3960	4320
18	x	22	3169	3366	3564	3762	3960	4158	4356	4752
18	x	24	3456	3672	3888	4104	4320	4536	4752	5184
18	x	26	3744	3978	4212	4446	4680	4914	5148	5616
18	x	28	4032	4284	4536	4788	5040	5292	5544	6048
18	x	30	4320	4590	4860	5130	5400	5670	5940	6480
18	x	32	4608	4896	5184	5472	5760	6048	6336	6912
18	x	34	4896	5202	5508	5814	6120	6426	6732	7344
18	x	36	5184	5508	5832	6156	6480	6804	7128	7776
20	x	20	3200	3400	3600	3800	4000	4200	4400	4800
20	x	22	3520	3740	3960	4180	4400	4620	4840	5280
20	x	24	3840	4080	4320	4560	4800	5040	5280	5760
20	x	26	4160	4420	4680	4940	5200	5460	5720	6240
20	x	28	4480	4760	5040	5320	5600	5880	6160	6720
20	x	30	4800	5100	5400	5700	6000	6300	6600	7200
20	x	32	5120	5440	5760	6080	6400	6720	7040	7680
20	x	34	5440	5780	6120	6460	6800	7140	7480	8160
20	x	36	5760	6120	6480	6840	7210	7560	7920	8640
20	x	38	6080	6460	6840	7220	7600	7980	8360	9120
20	x	40	6400	6800	7200	7600	8000	8400	8800	9600

TELEGRAPH CODE

VOLUNTEER

SIZE	STEAM	WATER	SIZE	STEAM	WATER
No. 0.....	Francis.....	May	No. 7½.....	Abraham.....	Blanche
No. 1.....	Peter.....	Helen	No. 8.....	Lewis.....	Mary
No. 1½.....	Oliver.....	Marion	No. 9.....	Thomas.....	Josie
No. 2.....	Edward.....	Clara	No. 9½.....	Simon.....	Bertha
No. 3.....	John.....	Sadie	No. 10.....	Robert.....	Kate
No. 3½.....	Daniel.....	Maude	No. 11½.....	Harold.....	Minnie
No. 4.....	Charles.....	Fanny	No. 12.....	Frank.....	Laura
No. 5.....	Frederick.....	Marjorie	No. 13½.....	Theodore.....	Emma
No. 5½.....	Lester.....	Lottie	No. 14.....	Joseph.....	Carrie
No. 6.....	William.....	Grace	No. 15.....	Willard.....	Lulu
No. 7.....	Norman.....	Martha			

VOLUNTEER JUNIOR

No. 11A.....	Ada	No. 19B.....	Isidor.....	Vera
No. 11B.....	Bridget	No. 19C.....	Walter.....	Mattie
No. 15A.....	Caroline	No. 19D.....	Samuel.....	Elsie
No. 15B.....	Ike.....	No. 23B.....	Ralph.....	Edith
No. 17B.....	David.....	No. 23C.....	Victor.....	Isabel
No. 17C.....	James.....	No. 23D.....	Clifford.....	Flora
		No. 23E.....	Reginald.....	Amelia

MONARCH (Old Style)

No. 105.....	Leon.....	Harriett	No. 205.....	Richard.....	Rebecca
No. 106.....	Chandler.....	Mabel	No. 206.....	Michael.....	Elizabeth
No. 107.....	Elliot.....	Louise	No. 207.....	Girard.....	Myra
No. 108.....	Percival.....	Jessie	No. 208.....	Amos.....	Lily
No. 109.....	Alexander.....	Nellie	No. 209.....	Clarence.....	Ella
No. 110.....	Donald.....	Margaret	No. 304.....	Nelson.....	Hilda
No. 111.....	Jack.....	Susan	No. 305.....	Emil.....	Madeline
No. 112.....	Earl.....	Mildred	No. 306.....	Calvin.....	Olive
No. 204.....	Phillip.....	Dorothy	No. 307.....	Matthew.....	Gladys

MONARCH (Push Nipple)

No. P 405.....	Leroy.....	Augusta	No. P 504.....	Mike.....	Nora
No. P 406.....	Harry.....	Daisy	No. P 505.....	Percy.....	Loretta
No. P 407.....	Billy.....	Eva	No. P 506.....	Joe.....	Agnes
No. P 408.....	Jim.....	Hattie	No. P 507.....	Bert.....	Lillian
No. P 409.....	Tom.....	Rose	No. P 508.....	Arthur.....	Ethel
No. P 410.....	Sam.....	Maggie	No. P 509.....	Phil.....	Eunice
No. P 411.....	Bob.....	Kitty	No. P 604.....	Ben.....	Alma
No. P 412.....	Teddy.....	Pearl	No. P 605.....	Dave.....	Madge
No. P 413.....	Abe.....	Becky	No. P 606.....	Pat.....	Ellen
No. P 414.....	Dan.....	Molly	No. P 607.....	Isaac.....	Rachael
No. P 415.....	Dick.....	Ruth			

MONARCH (Header)

No. H 705.....	Albert.....	Belle	No. H 805.....	Edwin.....	Estelle
No. H 706.....	Henry.....	Ann	No. H 806.....	Andrew.....	Kathleen
No. H 707.....	Herbert.....	Ruby	No. H 807.....	Benjamin.....	Viola
No. H 708.....	Fred.....	Alice	No. H 808.....	Jacob.....	Edna
No. H 709.....	Eugene.....	Gertrude	No. H 809.....	Raymond.....	Cecilia
No. H 710.....	George.....	Henrietta	No. H 904.....	Archie.....	Josephine
No. H 711.....	Ernest.....	Sarah	No. H 905.....	Max.....	Stella
No. H 712.....	Howard.....	Jane	No. H 906.....	Jerry.....	Flossie
No. H 804.....	Oscar.....	Eleanor	No. H 907.....	Alfred.....	Julia
At what price can you furnish.....			Full particulars in letter of.....		
At what price and how soon can			Do not understand meaning of.....		
you ship.....			Add to our order (No. or Date).....		
When can you ship.....			We can furnish immediately on		
What is the lowest freight rate to.....			receipt of order.....		
Have you shipped our order of			We can furnish at.....		
the—inst.....			Freight rate to.....		
Trace immediately shipment of.....			Shipped your order on.....		
When will you make shipment,			Ship via Express.....		
order dated.....			Ship via freight.....		
Change our order (No. or date)			Ship via boat.....		
to read.....					

